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Joint Command Decision Support for the 21st Century (JCDS 21) Technology Demonstration (TD) Project

Concept of Operations (CONOPs)

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Abstract

This document proposes a Concept of Operations for the Joint Command Decision Support for the 21st Century Technology Demonstration Project. It summarizes key underlying concepts, describes the DND/CF Command & Control model and outlines emergent Situational Awareness & Decision Support requirements. A set of principles derive from this initial analysis and a domestic humanitarian scenario is used as an illustrative vignette depicting application. This CONOPs is intended both to situate the JCDS 21 work program and to stimulate dialogue.

Resumé

Le présent document propose un concept d'opération pour le Système d'aide à la décision des commandements interarmées pour le XXI^e siècle relatif au Projet de démonstration de technologies. Il résume les concepts sous-jacents clés et décrit le modèle de commandement et de contrôle du MDN et des FC ainsi que les nouveaux besoins en matière d'aide à la décision et de connaissance de la situation. Cette analyse initiale a permis d'établir un ensemble de principes, et nous avons utilisé le scénario d'une opération nationale d'assistance humanitaire pour en illustrer l'application. Le concept d'opération vise à situer le programme de travail relatif au PDT ADCI 21 et à favoriser le dialogue.

Executive Summary

This document is a Concept of Operations (CONOPs) for a Joint Command Decision Support (JCDS) System. This document establishes the conceptual basis for future systems, outlines operational requirements, describes the Department of National Defence (DND)/Canadian Forces (CF) Command and Control (C2) model and situates the JCDS 21 work plan. The aim of the JCDS 21 TD Project is to demonstrate that a joint net-enabled collaborative environment can be exploited to achieve decision superiority and enhance operational effectiveness.

It is intended that this body of work will contribute to a greater understanding and eventual implementation of certain concepts and attributes described in the Department's Strategic Operating Concept (SOC). The results of studies and experimentation will test the assumptions relating to decision superiority and what is believed to be its key enablers. The JCDS 21 TD will work in collaboration with acquisition projects such as the Command and Control Information System (C2IS) project and the Joint Information and Intelligence Fusion Capability (JIIFC) project to develop operational and system requirements for a net-enabled collaborative environment to support strategic and operational decision-making, within a Joint, Interagency, Multinational and Public (JIMP) framework.

Previous JCDS 21 TD Project definition efforts have investigated Canadian Forces business processes and identified gaps where realization of new situational awareness and decision support concepts could contribute to enhanced operational effectiveness. The purpose of the CONOPs is to relate the requirements identified and the business processes modelled to the JCDS 21 structure and themes, with an initial focus on domestic operations.

During a 2-day JCDS 21 design workshop, the direction for the CONOPs was agreed upon by the workshop participants; the direction was outlined as the following:

- Provide strategic vision;
- Focus on Operational Level (e.g., CanadaCOM, Regional Joint Task Force)
- Integrate and position SP 3/4/5 objectives and work plans;
- Adopt an iterative approach; and
- Include the following concepts:
 - Command Centricity;
 - Process, Organization, and Technology;
 - Collaboration: information sharing, common customizable picture, integrated tool suite; and
 - Decision rights distribution.

This document attempts to distinguish between the multitude of Command and Control definition variants, and adopts the C2 model defined by Pigeau and McCann (2006). Decision making is also described as part of the C2 process, from the perspectives of Situation Monitoring, Awareness, and Analysis, Planning, Direction (Decision), and Execution. The

JCDS 21 unified decision making framework is presented – it depicts fundamental elements and presents an integrated vision of a decision making model. The model encompasses four domains: cognition, knowledge (information), organization and physical (observable effects).

The Canadian Forces decision making processes are also described. The complementary aspects between the Intelligence Preparation of the Battlefield (IPB) and Operations Planning Process are noted, as is the shift from Deliberate, Routine, and Crisis Planning to integrated Continuous Planning. In addition, this report discusses Canada Command's Command and Control Structure, in terms of Higher Authority, Partners and Peers, Subordinates Structure, and the Environment.

This CONOPs reflects considerable prior research and definitional effort by the JCDS 21 team. Expanding upon the preliminary stage-setting work (e.g. characterization of complex situations), JCDS 21 undertook to develop an understanding of existing staff planning and decision support activities and conducted a Front End Functional Area Analysis and Functional Needs Analysis. During these analyses, the Joint Staff (a grouping of Subject Matter Experts (SMEs)) provided information regarding their roles and responsibilities, and products and interactions, allowing the flow of events associated with the two illustrative case studies (one continental and one international) to be examined. Subsequent effort went into investigating extant process, organization and technology, conducting a detailed analysis of observation data, identifying the key factors affecting the staff's ability to discharge their responsibilities and defining system requirements. A preliminary Gap Analysis was conducted as part of this Front End Analysis, and is particularly relevant to this CONOPs (Greenley, Baker, & Cochran, 2006). The Gap Analysis included consideration of complexity and risk dimensions.

The results of the Front End Functional Needs Analysis provided the genesis of a requirements assessment and shaped the development of the JCDS 21 program and work breakdown structure (WBS) i.e., provided a baseline for structuring elements of a future Functional Solution Analysis. This document outlines the gaps identified and relates them to JCDS 21 sub-project groupings. Subsequently JCDS 21 was afforded an opportunity to observe a Command Post Exercise (CPX), ARDENT SENTRY. It was significant in that it was 1) the first large scale multifaceted exercise in which Canada Command participated; 2) the first time that the CF and Public Safety and Emergency Preparedness Canada (PSEPC) collaborated on an exercise of this magnitude; and 3) the first time since the inception of US NORTHCOM that the CF participated significantly in a US-led Homeland Security exercise. ARDENT SENTRY provided an opening to test innovative Command and Control concepts of operations related to domestic operations and was used to identify operational requirements and shortfalls. The Exercise also confirmed shortfalls and challenges identified in the initial JSTAFF Front End Analysis.

The CONOPs also describes operational requirements for decision support. A number of general deductions and a series of operational requirements can be extracted from the review of Command and Control and Decision Making models; these deductions and requirements are correlated with the JCDS 21 Subprojects (SPs), including Human and Organization Factors, Situational Awareness, and Planning and Decision Support. The JCDS 21 Initial CONOPs is also presented in terms of the Process, Organization, and Technology (POT) dimensions (i.e., the CONOPs is described with reference to the JCDS 21 Sub-Projects).

Finally an illustrative vignette (domestic humanitarian scenario) is used to illustrate the application of the Concept of Operations. In the scenario, a massive earthquake, registering 8.5 on the Richter scale, has occurred 150 kilometres (km) off the British Columbia and Washington coast. The earthquake, in turn, has generated a substantial tsunami, which has struck without warning. The CONOPs is applied from the perspective of the Planning/Operations/Response Model.

Sommaire

Le présent concept d'opération porte sur un système d'aide à la décision des commandements interarmées (ADCI). Il établit la base conceptuelle de systèmes futurs, décrit les besoins opérationnels ainsi que le modèle de commandement et de contrôle (C2) du ministère de la Défense et des Forces canadiennes et situe le plan de travail de l'ADCI 21. Le PDT ADCI 21 vise à montrer qu'il est possible d'exploiter un environnement de collaboration réseaucentrique interarmées pour obtenir la supériorité en matière de décision et accroître l'efficacité opérationnelle.

Ces travaux devraient permettre de mieux comprendre et mettre en oeuvre éventuellement certains concepts et attributs décrits dans le concept d'opération stratégique (COS) du Ministère. Les résultats d'études et d'expériences confirmeront les hypothèses relatives à la supériorité en matière de décision et ce qui en constitue, à notre avis, ses principaux catalyseurs. L'équipe du PDT ADCI 21 travaillera en collaboration avec les équipes des projets d'acquisition, tels que celui du système d'information de commandement et de contrôle (SICC) et du Projet de capacité de fusion de l'information et du renseignement interarmées (CFIRI) pour mettre au point les besoins opérationnels et les caractéristiques du système qui sont nécessaires pour établir un environnement de collaboration réseaucentrique soutenant les décisions stratégiques et opérationnelles à l'intérieur d'un cadre interarmées, inter-institutions, multinational et public (JIMP).

Les travaux antérieurs de définition du PDT ADCI 21, qui portaient sur les processus administratifs des Forces canadiennes, ont permis de définir les cas où la réalisation de nouveaux concepts de connaissance de la situation et d'aide à la décision pourrait aider à améliorer l'efficacité opérationnelle. Le concept d'opération vise à rattacher les besoins énoncés et les processus administratifs modélisés à la structure et aux thèmes du PDT ADCI 21, en mettant d'abord l'accent sur les opérations nationales.

Au cours d'un atelier d'une durée de deux jours sur la conception du PDT ADCI 21, les participants se sont entendus sur l'orientation du concept d'opération, à savoir

- fournir une vision stratégique;
- se concentrer sur le niveau opérationnel (p. ex., Commandement Canada, Force opérationnelle interarmées régionale);
- intégrer et positionner les objectifs 3/4/5 et les plans de travail de sous-projet;
- adopter une approche itérative;
- inclure les concepts suivants :
 - commandement centralisé;
 - processus, organisation et technologie;
 - collaboration : échange d'information, image commune personnalisée, outils intégrés;
 - répartition des droits décisionnels.

Le présent document cherche à faire la distinction entre les diverses définitions du commandement et du contrôle et adopte le modèle de C2 défini par Pigeau et McCann (2006). La prise de décisions y est aussi décrite dans le cadre du processus de commandement et de contrôle, du point de vue de la surveillance, de la connaissance et de l'analyse de la situation, de la planification, de la direction (décision) et de l'exécution. Nous y présentons le cadre décisionnel commun, qui décrit les éléments fondamentaux et présente une vision intégrée d'un modèle de décision. Le modèle englobe quatre domaines : la cognition, la connaissance (information), l'organisation et les effets physiques (visibles).

Nous y décrivons aussi les processus décisionnels des Forces canadiennes. Les aspects complémentaires entre l'analyse tactique graphique et le processus de planification des opérations sont exposés, tout comme le passage de la planification délibérée, systématique et en situation de crise à la planification continue intégrée. Le rapport aborde en outre la structure de commandement et de contrôle du Commandement Canada, quant à l'autorité supérieure, aux partenaires et aux pairs, à la structure de subalternes et au service concerné.

Le présent concept d'opération reflète la somme considérable de travail antérieur de recherche et de définition accomplie par l'équipe du PDT ADCI 21. Développant les travaux préparatoires préliminaires (p. ex., la caractérisation de cas compliqués), l'équipe du PDT ADCI 21 a entrepris d'élaborer une vision commune des activités actuelles de planification et d'aide à la décision de l'état-major, et elle a analysé les domaines et les besoins fonctionnels initiaux. Pendant ces analyses, les membres de l'état-major interarmées (un groupe d'experts en la matière) ont fourni de l'information sur leurs rôles et responsabilités ainsi que sur les produits et interactions, ce qui a permis d'examiner le déroulement des événements associés aux deux études de cas explicatives (l'une sur une opération continentale et l'autre sur une opération internationale). Nous avons ensuite mené une enquête sur l'organisation, la technologie et le processus existants, analysé de façon détaillée les données basées sur l'observation, déterminé les principaux facteurs influant sur la capacité de l'état-major de s'acquitter de ses fonctions et défini les besoins du système. Dans le cadre de cette analyse initiale, nous avons d'abord examiné les lacunes, ce qui est tout particulièrement pertinent dans le cas du présent concept d'opération (Greenley, Baker et Cochran, 2006). Dans cette analyse, nous avons tenu compte de la complexité et du risque.

Les résultats de l'analyse initiale des besoins fonctionnels ont fourni la genèse d'une analyse des besoins et ont influencé l'élaboration du programme ADCI 21 et de la structure de répartition du travail, c.-à-d. qu'ils ont servi de référence pour les éléments de structuration d'une analyse ultérieure des solutions fonctionnelles. Le présent document décrit les lacunes définies et les rattache aux sous-projets ADCI 21. Par la suite, l'équipe du PDT ADCI 21 a eu l'occasion d'observer l'exercice de poste de commandement *Ardent Sentry*. Cet exercice était important en ce sens que c'était 1) le premier exercice à facettes multiples de grande envergure auquel participait le Commandement Canada; 2) la première fois que les FC et Sécurité publique Canada collaboraient dans le cadre d'un exercice de cette ampleur et 3) la première fois depuis la création du Commandement du Nord des États-Unis (USNORTHCOM) que les FC participaient de façon importante à un exercice de sécurité intérieure dirigé par les États-Unis. L'exercice *Ardent Sentry* a permis de vérifier des concepts de l'opération novateurs en matière de commandement et de contrôle d'opérations nationales et a servi à définir les besoins opérationnels et les lacunes. Il a aussi confirmé les lacunes et les problèmes définis au cours de l'analyse initiale de l'état-major interarmées.

Le concept d'opération décrit aussi les besoins opérationnels relatifs à l'aide à la décision. Un examen des modèles de commandement et de contrôle et de prise de décisions permet aussi de tirer un certain nombre de déductions générales et d'établir un ensemble de besoins opérationnels : ces déductions et besoins sont mis en corrélation avec les sous-projets du PDT ADCI 21, y compris les facteurs humains et organisationnels, la connaissance de la situation et la planification et l'aide à la décision. Le concept d'opération initial du PDT ADCI 21 est aussi présenté du point de vue du processus, de l'organisation et de la technologie (c.-à-d. qu'il est décrit par rapport aux sous-projets du PDT ADCI 21).

Enfin, le scénario d'une opération nationale d'assistance humanitaire est utilisé pour illustrer l'application du concept d'opération. Dans le scénario, un séisme majeur, d'une magnitude de 8,5 sur l'échelle de Richter, s'est produit à 150 km de la côte de la Colombie-Britannique et de l'État de Washington et a engendré, à son tour, un important tsunami qui a frappé sans prévenir. Le concept d'opération est appliqué du point de vue du modèle Planification, opérations, intervention.

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1 Introduction

This document is a Concept of Operations (CONOPs) for a Joint Command Decision Support (JCDS) System¹. It is the key deliverable for Call-Up 001 under the Joint Command Decision Support for the 21st Century (JCDS 21) Technology Demonstration (TD) Project. It establishes the conceptual basis for future systems, outlines operational requirements, describes the Department of National Defence (DND)/Canadian Forces (CF) Command and Control (C2) model and situates the JCDS 21 work plan.

1.1 Overview of JCDS 21

The aim of the JCDS 21 TD Project is to demonstrate that a joint net-enabled collaborative environment can be exploited to achieve decision superiority and enhance operational effectiveness.

The Military Operational Research Society (MORS) defines capability as “the ability to achieve a desired effect under specified standards and conditions through combinations of means and ways to perform a set of tasks”.² The MORS capability definition is consistent with most national definitions and includes implicit recognition that an aggregation of contributing constituents is needed to generate capability. In its simplest decomposition, Process, Organization and Technology (POT) are the fundamental components and are essential to the establishment of a ‘net-enabled collaborative environment’. The effective integration of practice, people and equipment to conduct collaborative work is considered key to achieving decision superiority; hence an understanding of organizational and individual factors is the first pre-requisite. Other dimensions include the establishment of situational awareness, innovative planning and decision support and effective execution and oversight. Shared intent and trust among teams, data fusion, knowledge management and presentational staging are also among the factors that will be investigated and measured in this project.

The complexity of the challenge facing the Canadian Forces will place demands on the existing Command and Control system, requiring inventive enquiry and innovative technology capable of supporting critical thinking, team building, and course of action (COA) development, shared situation awareness (SA) and execution management. JCDS 21’s stated aim is to demonstrate concepts, strategies and technologies to support situation analysis and intelligence, visualization, action support and operations management.

It is intended that this body of work will contribute to a greater understanding and eventual implementation of certain concepts and attributes described in the Department’s Strategic Operating Concept (SOC). The results of studies and experimentation will test the assumptions relating to decision superiority and what is believed to be its key enablers. The

¹ The DND/CF defines decision support as tools and techniques to support decision-making by enhancing the information/data gathering process and/or providing an efficient method to evaluate alternatives (http://vcds.mil.ca/dgsc/pubs/support/dss/faq_e.asp).

² MORS Capability Based Planning Workshop, Washington, October 2004.

JCDS 21 TD is targeting acquisition projects such as the Command and Control Information System (C2IS) project and the Joint Information and Intelligence Fusion Capability (JIIFC) project for its exploitation strategy. JCDS 21 TD will deliver operational and system requirements for a net-enabled collaborative environment to support strategic and operational decision-making, within a Joint, Interagency, Multinational and Public (JIMP) framework.

The JCDS 21 sub objectives include:

- Understand the implications of net-centric operations within a Joint Interagency Multinational Public framework;
- Enhance the existing (Command View (CV)) collaborative situation awareness environment;
- Develop operational and system requirements for related acquisition projects;
- Contribute to the Public Security Technology Programme (PSTP) by sharing the results of studies and experimentation and collaborating on problems of common interest;
- Design and demonstrate a net-enabled collaborative environment that supports:
 - CF decision-making processes within a JIMP framework;
 - Exploitation of information and knowledge; and
 - Collaborative work among distributed teams;
- Advance achievement of shared intent and decision superiority within a unified command framework;
- Build a decision support test facility (test bed); and
- Develop Measures of Effectiveness (MOEs) and Measures of Performance (MOPs) to assess decision aides.

The JCDS 21 TD project is structured around the following themes/sub-projects (SPs):

- Project Management (SP1): This sub-project clusters all project management and execution control activities.
- Front-end Analysis and Experimentation (SP2): The objective of SP2 is to employ formal systems engineering processes for analysis and requirements capture, and to employ human engineering processes for identification of the impact of human limitations and capabilities in providing specifications for human interface requirements. In support of the other SPs, SP2 will also help develop and support a JCDS Experimentation Campaign.
- Organizational and Individual Factors (SP3): SP3 intends to develop strategies to achieve organizational agility and to improve decision performance of the individual, team, and organization, which is critical for achieving integrated planning and execution in a JIMP environment.
- Situation Awareness (SP4): SP4 focuses on the representation and management of information and knowledge to support the intelligence cycle, taking into consideration the Process, Organization and Technology aspects of the problem

domain. The aim is to demonstrate the integration of concepts and technologies to enhance the SA of military decision makers by providing key enablers to support the situational assessment, particularly when working in distributed teams.

- Decision Support (SP5): SP5 investigates and demonstrates advanced decision-aid concepts to support the joint decision making process. SP5 investigates CF processes/tools such as decision-making analysis, planning, operations management, and workflow and feedback tools, and provides solutions to lessen cognitive workload.
- Systems Integration and Interoperability (SP6): The main objective of SP6 is to develop and implement a JCDS 21 TD test-bed that will support systems integration from both a technological and human perspective, and to ensure interoperability between the participating components/sub-systems of the overall JCDS 21 TD system. The test-bed will serve as the principal platform to support experimentation conducted under the JCDS 21 TD project.

1.2 Motivation behind the Decision Support CONOPs

Previous JCDS 21 TD Project definition efforts have investigated Canadian Forces business processes and identified gaps where realization of new situational awareness and decision support concepts could contribute to enhanced operational effectiveness. The purpose of this CONOPs is to relate the requirements identified and the business processes modelled to the JCDS 21 work plan. Although it has been agreed that this operational concept will focus on domestic (e.g., Canada Command [CanadaCOM]) operations, many of the issues discussed are generic Command and Control challenges. It is understood that this CONOPs will be used to inform detailed planning as well as the development of a high level functional architecture.

In support of these objectives, a 2-day JCDS 21 design workshop was held in Valcartier 21/22 February, 2007. The primary objective of the workshop was to refine the JCDS 21 work plan and to provide direction to the contracting teams (also present) to create the Concept of Operations (CAE PS) and the High Level Functional Architecture (Fujitsu). The workshop provided an opportunity for sub-team leads to describe hypotheses and plans, and to identify and outline expectations. During the workshop, the direction for the CONOPs was agreed upon by the workshop participants; the direction was outlined as the following:

- Provide strategic vision;
- Focus on the Operational Level (e.g., CanadaCOM, Regional Joint Task Force [RJTF])
- Integrate and position SP 3/4/5 objectives and work plans;
- Adopt an iterative approach; and
- Include the following concepts:
 - Command Centricity;
 - Process, Organization, and Technology;

- Collaboration: information sharing, common customizable picture, integrated tool suite; and
- Decision rights distribution.
 - The conceptual backdrop is discussed in more detail in Section 5.6: Decision Rights. In short, Effects Based Planning can be viewed as both an acknowledgement of increasing interdependence and an attempt to operationalise the principle of unity of effort and to reverse engineer strategy on a grand scale. Net Enabled Operations is a complementary concept seeking to leverage emergent business practices and to exploit the potential pervasive communications offer. Mission Command addresses the challenges multiple stakeholders and cross-disciplinary coordination pose by proposing a centralized policy formation / decentralized implementation paradigm. A key enabler to realization is a Collaborative Information Environment which facilitates the exchange of information, development of a shared appreciation, joint planning and synchronized execution. Doctrinal change is needed to supplement and take advantage of technological innovation. Decision Rights involves institutionalization of a Competency, Authority and Responsibility model addressing governance in a distributed environment, i.e. agreement on who should make what decisions when. These notions were raised at the workshop hosted by DRDC in Valcartier (minutes providing a high-level overview of the primary discussions, decisions, and action items were provided (Scipione & Hales, 2007)).

1.3 Document Structure

There was considerable thought and discussion surrounding the development of the document structure. This was necessary to ensure the inclusion of a conceptual backdrop, requirements identification, requirements application to the JCDS 21 project structure, and the exploitation of a vignette to illustrate how emergent POT factors might be employed in the context of a domestic scenario. Specifically, the CONOPs is structured as follows:

- Section 1 – Introduction: Brief synopsis of JCDS 21 along with the motivation for developing a Decision Support CONOPs;
- Section 2 – Understanding Command Decision-Making: Describes Command and Control and associated C2 functions, and details decision making domains and processes as part of Command and Control.
- Section 3 – Overview of CF Decision-Making Processes: Identifies decision making processes within the Canadian Forces, and provides a Case Study of Canada Command's C2 Structure.
- Section 4 – Initial Decision Support Gaps Analysis: Summarizes previous work and findings completed to date under the JCDS 21 TD project auspices;

- Section 5 – Operational Requirements for Decision Support: Outlines the operational requirements which support the joint decision making process;
- Section 6 – JCDS 21 CONOPs: Outlines the CONOPs for JCDS21 from the perspective of the human and organization, situation awareness, and planning and decision support.
- Section 7 – Illustration of JCDS 21 CONOPs: Application of the Planning/Operations/Response Model: Describes an illustrative application of the Concept of Operations using an operational scenario (a massive earthquake off the British Columbia/Washington coast);
- Section 8 – Summary: Provides a high-level summary of the CONOPs;
- Section 9 – Acronyms: List of acronyms used in this document;
- Section 10 – Glossary: Definitions/descriptions for terms used within the CONOPs; and
- Section 11 – References: Citations for the documents used during the development.

2 Understanding Command Decision-Making

2.1 Command and Control

There are several minor variants of the definition of Command and Control. The most widely quoted departure point is the US Department of Defense's definition: the exercise of authority and direction by a properly designated Commander over assigned and attached forces in the accomplishment of a mission.³ This definition describes functional requirements (efficient and effective administration) without prescribing means (how Command and Control is to be applied). The importance of charismatic leadership is recognized in the literature, and is reflected in recruitment and selection policies, but is not included in the U.S. or most definitions. Furthermore, doctrine often distinguishes leadership approaches and relates the effectiveness of Command style to the contextual setting (i.e., an autocratic slant is preferable when time precludes discussion). Command itself is a separate entity which involves both formal/legal lines of authority and informal/personal sanction. Integral to the U.S. and CF definitions of C2 are notions of legitimacy and reciprocal responsibilities. Command is duly appointed and accountable for both resource utilization (including the well-being of allocated forces) and the accomplishment of an objective. For JCDS 21 purposes, Command is considered the creative and purposeful exercise of legitimate authority to accomplish the mission legally, professionally and ethically. This definition is attractive since it captures the elemental concepts, introduces the idea that competent commanders can exercise authority creatively and makes implicit reference to a social contract underpinned by common ethics. Figure 1 was developed by DRDC Toronto scientists and depicts three key dimensions of Command: Competency, Authority and Responsibility.⁴ Functional Command must provide for competent decision makers, license them to apply judgment and provide the resources to permit them to act (Pigeau & McCann, 2005; 2002).

³ C2 JFC pg 2

⁴ Competence includes physical, intellectual, emotional and interpersonal attributes and skills. Authority refers to domain of influence and responsibility to the acceptance of legal and moral liability. Pigeau and McCann argue that the CAR dimensions can be used to map out command capability and define a Balanced Command Envelope (Pigeau, R. & McCann, C. (2002). *Re-Conceptualizing Command and Control*, Canadian Military Journal, 3(1); pg. 53-64).

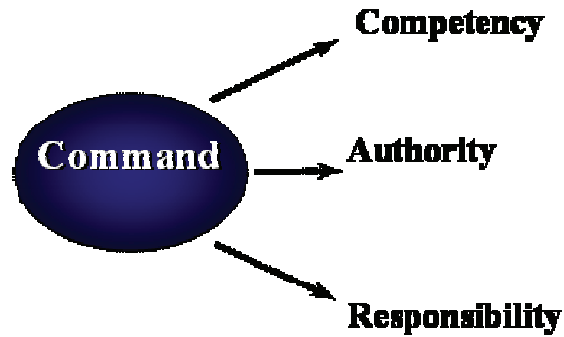


Figure 1: Three Key Dimensions of Command (Pigeau & McCann, 2005; 2002)

Control provides the means to apply Command (Figure 2). Command can be thought of as “the creative expression of human will necessary to accomplish the mission”.⁵ Conversely Control can be thought of as the structures, processes/tools, and techniques devised by Command to enable assigned authority to be exercised. This includes procedures for dealing with uncertainty and managing risk. The NATO definition refers to that authority exercised by a Commander over part of the activities of subordinate organizations, or other organizations not normally under his control, which encompasses the responsibility for implementing orders or directives.⁶

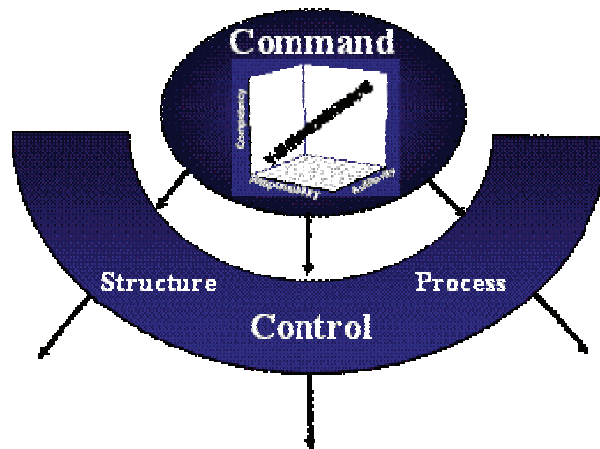


Figure 2: Control as the Means to Apply Command (Pigeau & McCann, 2005; 2002)

Obviously Command and Control are inextricably linked and complementary. Command creates and adjusts administrative structures and management processes. Hence Command is

⁵ Pigeau, R. & McCann, C. (2002). *Re-Conceptualizing Command and Control*, Canadian Military Journal, 3(1); pg. 56. Pigeau, R. & McCann, C (2005). Framework for Evaluating Control Structures. Presentation for a DRDC Workshop in Support of the CDS Transformation.

⁶ APP-6 (S)

pre-eminent and Control subordinate. Control has historically been constrained by the span and depth of supporting Communications. For a long period of time, the size of opposing forces remained stable. Up until 1815 “battle remained very much what it had always been: a question of men standing up, at a certain carefully defined time and space (battles tended to be over in a few hours and seldom took up more than a few kilometres [Km]), in relatively tight formations (throughout the eighteenth century there had been an intense debate on the relative merits of the column versus the line) and fighting one another in full view of the other.”⁷ Post Waterloo, with the advent of the industrial age mobilization, Command moved from the man on horseback to professional staffs and sophisticated operations centres. What has not changed is the essence of Command – the requirement to make timely decisions in the face of uncertainty, to identify and evaluate alternatives and determine choice based on available Information and Intelligence (I2) and as conditioned by training and experience. Information augments and complements Intelligence. Intelligence can be used to situate incoming data and through examination Information can be used to modify past analysis. Here, two traditional barriers are being challenged; the historic distinction between Information and Intelligence is eroding and provision has been made for Intelligence to be an active participant in coordination centres (e.g., National Defence Command Centre (NDCC)) charged with helping create a common operating picture (COP)). Current Information places Intelligence in perspective and tactical exploitation now more readily yields Strategic impact. Co-location on a 24-hour 7-day a week basis ensures Intelligence is not overlooked and provides for a prompt response through “Request for Information (RFI)” procedures for detailed investigation and analysis. Command and Control have co-evolved with technology. Computers have augmented and expanded the ability of humans to visualize, analyze and calculate; in some instances, such as missile defence when reaction time is critical, computers are sanctioned to exercise judgment and initiate engagement. One challenge in a future Command and Control system relates to jurisdictional determinations (i.e., how to leverage the advantages computers offer and when to concede human hegemony and defer decisions to software).

2.2 Command and Control Functions

A functional decomposition of Command and Control is useful as it provides a construct for analysis, a basis for modeling, and a departure point for developing metrics to measure effectiveness. Although originally developed by Col John Boyd to depict the decision cycle of a fighter pilot, the Observe, Orient, Decide & Act (OODA) Loop has become a convenient model to describe core Command and Control functions.⁸ The OODA model is one of the best known and popular models. The model views decision making as a rational, cyclical process and infers that the functions are discrete. Boyd draws particular attention to the significance of orientation. Orientation shapes observations, decisions and actions; misperceptions including deliberate deceptions can be fatal. Perhaps more significantly, Boyd suggests that decision-making cycles operate at different speeds and competitive advantage will accrue to completing the cycle before the enemy (a premium is placed on speed of Command and the ability to control tempo and to make and enact decisions faster than an

⁷ Van Creveld, M. (2000). *The Art of War: War and Military Thought*. Cassell, London; pg. 120-121.

⁸ Boyd never wrote a book on military strategy. His theory was explained in an extensive slide presentation “Discourse on Winning & Losing” and a short essay “Destruction & Creation” (1976).

adversary can react). Information Superiority and Decision Superiority concepts can be related to the OODA model. Information Superiority contributes to enhanced data collection (observation), analysis and knowledge management (KM) (orientation) functions, and contributes to better decisions and the process engineering to operate with an opponent's decision cycle.

The OODA Loop (Figure 3 and Figure 4) has provided the departure point for recent Deputy Chief of Defence Staff (DCDS) initiatives. Notably, it has supported CF Command, Control, Communications, Computers, Intelligence, Surveillance and Reconnaissance (C4ISR) Campaign Planning and the development of the Target Implementation Model (TIM), and has been used by the Integrated Command and Control (Integrated C2) Project, the Command, Control, Communications, Computers and Intelligence (C4+I) Capability Engineering Team (CET) and by JCDS 21.

The OODA Loop is described as follows:

- Observe: Gather sensory input
 - Scan the environment and collect information.
- Orient: Develop situational awareness
 - Place the information in context, synthesize it and use it to generate a mental image of the circumstances to identify and evaluate potential responses. Situational awareness provides the backdrop for conceiving and assessing a course of action (COA).
- Decide: Authorize action
 - “Command”, vested in individuals, provides the legal and social legitimacy and authority to judge and select a COA. Decide involves formulating intent, assigning objectives and sanctioning a COA.
- Act: Oversee execution
 - At lower levels, Act involves conducting specified tasks. Conversely, at the Command level, the concept of Control needs to be introduced; it involves ensuring decisions are disseminated, intent is understood, activities are coordinated, and effects are monitored.

It is interesting to note that the Integrated C2 and the C4+I Capability Engineering Team felt obligated to add a 5th enabling function:

- Communication: Share information and collaborate
 - There is a requirement to ensure the judicious flow of data and information to sustain the Observe, Orient, Decide and Act functions. Increasing managerial and operational interdependence has placed a premium on collaboration as a means to engage, exploit and empower a professional

workforce. Knowledge Management is a key enabler and an imposing challenge.

2.3 CF Target Integration Model

The CF Target Integration Model and the C4ISR campaign were based on the OODA Loop, as represented in Figure 3, Figure 4, and Figure 5.⁹ Figure 3 depicts the integration of traditional Intelligence and Information cycles. In the past, the key differentiators were analytical quality and temporal horizon; traditionally more time and specialist expertise was applied to Intelligence and it provided the backdrop for decision making. Compressed decision cycles have mandated closer integration of the two. The model shown in Figure 4 underscores the requirement to fuse Intelligence and Information to produce a current, coherent picture to support decision making. This summation is used to “decide” Operational options and to “direct” Intelligence efforts. As illustrated, the two processes can no longer be easily separated. Although there is minor variance in terminology, in essence, the left hand side describes the Intelligence Cycle (e.g., Direction, Collection, Processing and Dissemination). Security sensitivities related to collection of Intelligence are a key differentiator and explain why, for the foreseeable future, a mirrored two loop model is appropriate. (Typically any reference to sources is eliminated and Intelligence products are “reduced” to Secret to allow sharing with the Information/Operations side and to facilitate collation).

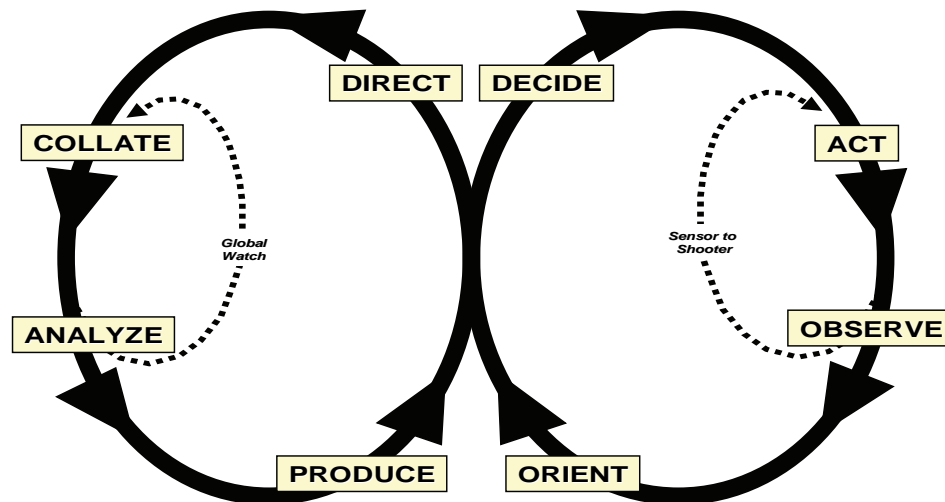


Figure 3: Information & Intelligence Cycles (CF C4ISR Campaign Plan)

⁹ Department of National Defence, Canadian Forces C4ISR Campaign Plan: Target Integration Model 2008 Operational Requirements, 7 July 2004.

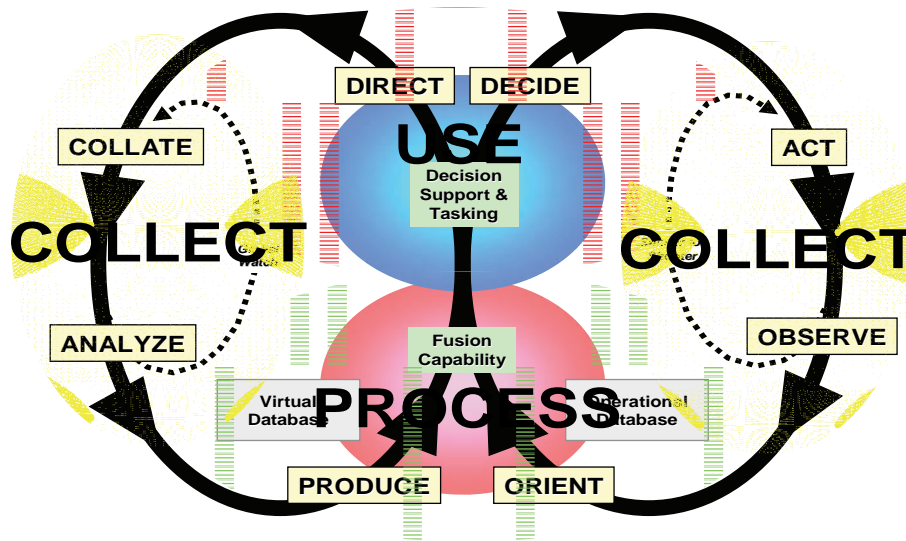


Figure 4: Information & Intelligence Functional Linkage (CF C4ISR Campaign Plan)

The Target Integration Model 2008 (Figure 5) portrays the CF Command and Control structure. Intelligence and Information (prior analysis and current data) co-exist within a protected Collaborative Information Environment (CIE). These are combined to create an integrated COP and to provide decision makers and staffs with a shared summation and visualization of operationally relevant knowledge. The COP provides the departure point for both exploring options and monitoring execution of a plan. This Operations Planning Process (OPP) is well described in the CF doctrine.

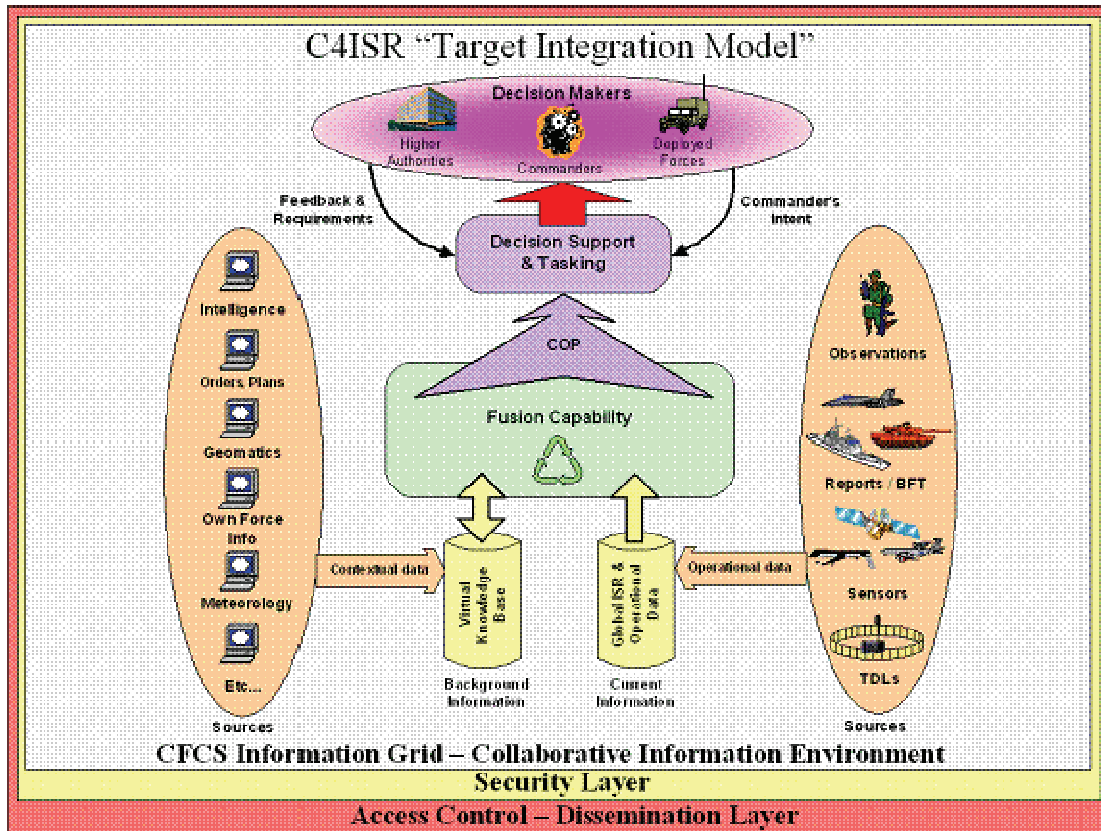


Figure 5: CF Target Integration Model 2008 (CF C4ISR Campaign Plan)

2.4 The Integrated C2 Model

Prior reference (Section 2.2: Command and Control Functions) was made to the Integrated C2 Study commissioned by the DCDS' Director of Joint Force Concepts in 2005. The objective was to conduct Functional Area and Functional Needs Analyses¹⁰ and identify the gap between the "As Is" and an integrated C2 system. An evaluation of Transformational C2 Concepts was conducted, a Concept of Operations was prepared and an update to TIM 08 model was proposed. Due to organizational re-engineering, the analysis was not completed. However, the conceptual model developed (Figure 6) has merit and provides useful insight and a convenient construct for situating Canada Command.

¹⁰ The US Joint Capabilities Integration and Development System (JCIDS) process distinguishes between Functional Area Analysis (FAA), Functional Needs Analysis (FNA) and Functional Solutions Analysis (FSA). The aim of a FAA is to identify the operational tasks, conditions and standards needed to accomplish military objectives. Conversely a FNA is intended to assess the ability of current and programmed capabilities to accomplish these tasks. A FSA assess potential solutions (materiel and non-equipment) approaches to resolving capability gaps.

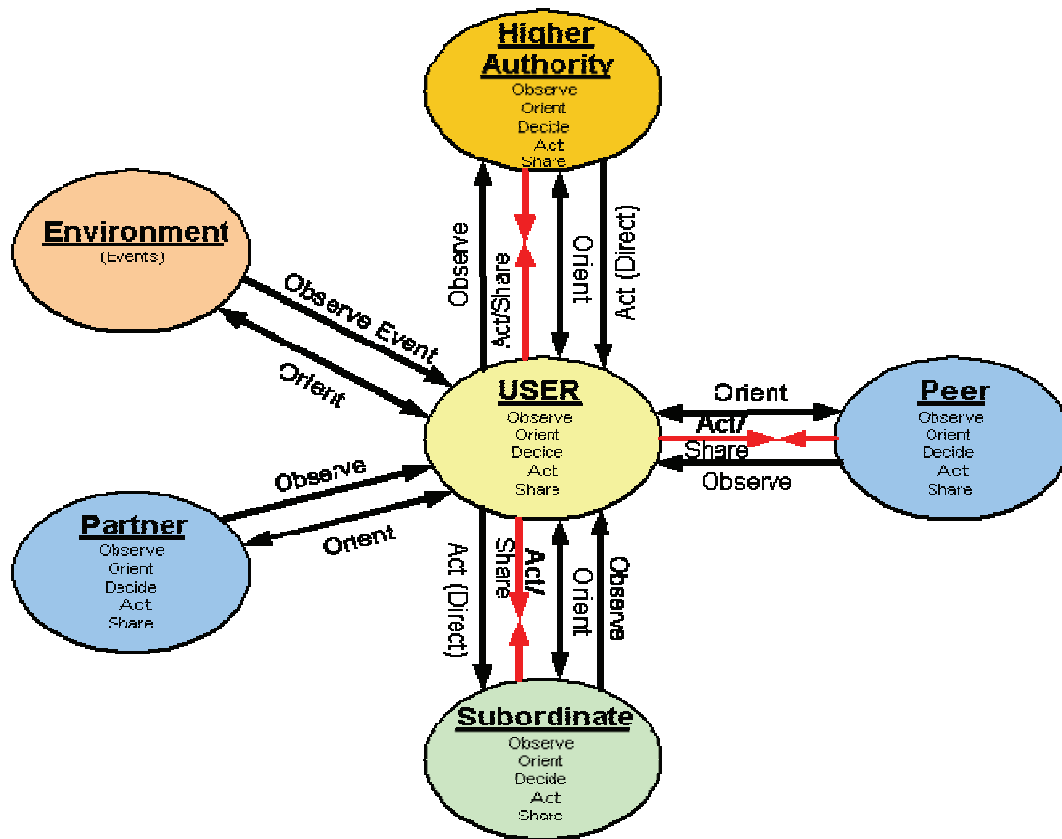


Figure 6: The Integrated C2 Model (Integrated C2 Project)

2.5 Decision-Making as part of Command and Control

Notwithstanding the import of communications and computers, Command and Control is fundamentally a human activity, and organization and technology exist to support the human dimension of decision making. In essence, the C2 process can be viewed as systemic execution of collection, perception, projection and choice. Figure 7 provides graphic elaboration, encapsulating the complexity of Command and Control and underscoring the importance of mental models and the cognitive domain. Through the employment of ISR and the mining of civilian and military sources, headquarters gather and process huge quantities of heterogeneous information. The decision-maker needs to make sense of the situation and understand its dynamics. Once situation awareness is achieved, a thought-driven process starts to determine possible actions and effects against a set of higher-level (strategic) objectives or goals. The Commander will be advised with respect to the best way to intervene. Based on his personal mental model(s) and background, the Commander will develop his intent, which he will communicate in an understandable format to his staff and organization. The implementation of the Commander's intent requires a broad spectrum of people, units, teams and capabilities. It is therefore, important to ensure that the Commander's intent is well understood and implemented as intended; translated into tasks, orders and operations. A rapid feedback loop is essential to assess whether the implementation and unfolding events are in accordance with the Commander's intent. Execution management will assist decision-makers

to adapt to changes in the situation and to make necessary changes in plans. Effects resulting from actions taken will be observed and measured. This representation is Command centric and does not deal with the collaboration. For instance, collaboration between Commanders and Headquarters (HQ) is not shown.

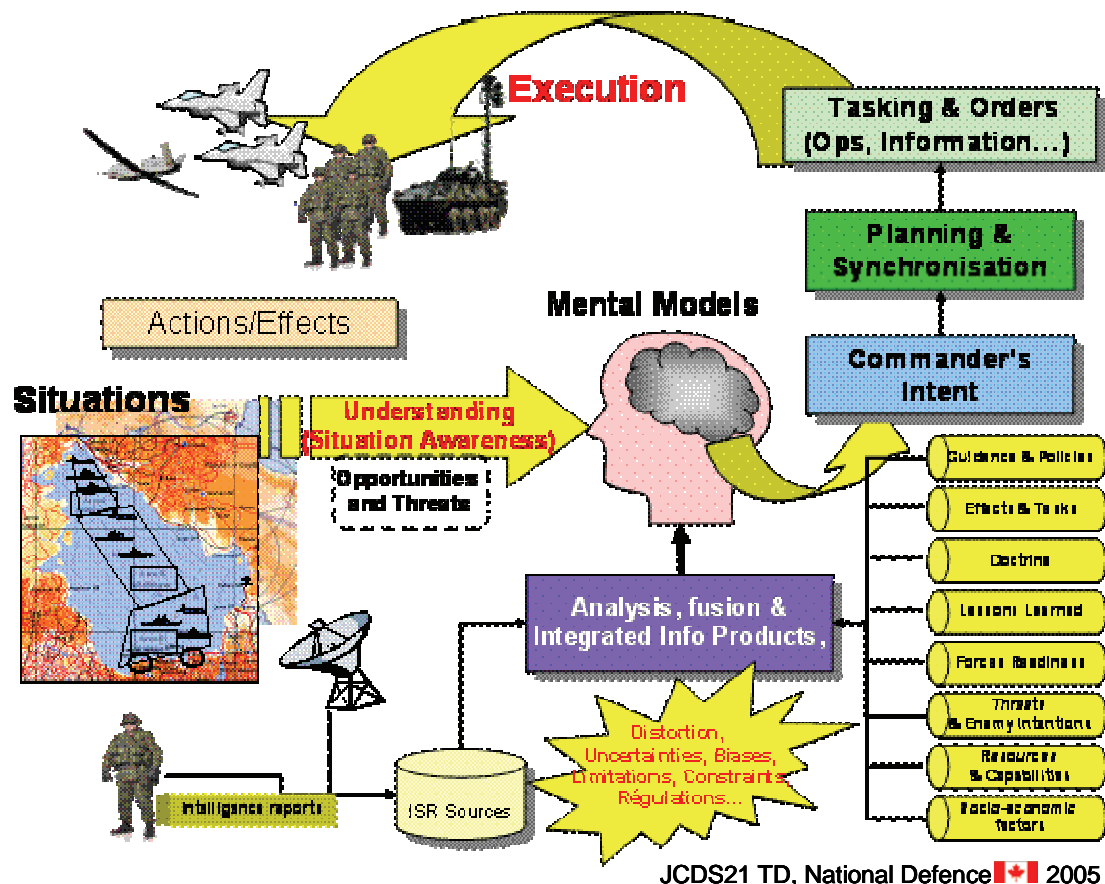


Figure 7: Key Functional Activities of Command and Control

2.5.1 Situation Monitoring, Awareness and Analysis

As with most Decision-Making models, Figure 7 distinguishes an initial “orientation” function. The first step is to identify prevailing circumstances. Awareness and analysis can be both individual and collective. Education and experience assist in recognizing actors, factors and relationships. The product is a situational understanding. Plans and Decisions are perception driven.

2.5.2 Planning

Situation monitoring, awareness, and analysis inform planning. Tipping points/centres of gravity are determined and alternatives identified and evaluated. Again, this is scalar and the formality of the process can vary. Typically planning involves two distinct activities: 1) the

assessment and selection of an option; and 2) implementation coordination/activity synchronization.

2.5.3 Direction (Decision)

Models emphasize systemic procedure and feature critical decision points. In practice, decision making is more akin to a continuous, streaming process. Goals, resources, uncertainty, and risks are being constantly appraised and decisions taken. Direction involves enterprise guidance and management. Such instruction can be vague and tacit, or specific and overt. In more formal military processes, key decisions include determining objectives, establishing the appropriate Competence, Authority and Responsibility construct, and allocating resources. Direction has become synonymous with orders and more recently, Command Intent.

2.5.4 Execution

Execution is the application of decisions and the performance of directed tasks. The specificity of the direction may vary leaving leeway for interpretation in execution. The feedback loop is particularly significant as Execution may alter Situational Understanding, require Plans to be adjusted, new Decisions to be taken, and Direction to be amended.

2.5.5 Collaboration

According to the Webster's Revised Unabridged Dictionary (1998), Collaboration is defined as "The act of working together; united labour". The fourth edition of the American Heritage Dictionary defines collaboration as "To work together, especially in a joint intellectual effort". Distribution might refer to temporal and/or spatial (geography) dispersion of the team participants. Collaborative planning might be defined as the joint intellectual effort of at least two agents (teams, individuals, organizations and/or virtual agents) engaged into a common planning process to achieve a common (shared) intent. Distributed collaborative decision-making might be seen as "the process by which the collective intellectual power, experience and knowledge of distributed command and staff teams are applied to achieve desired effects and avoid undesired or collateral effects (achieve the mission)." It is the fundamental activity of determining what to do and how to propagate it among subordinates. Commander's intent for a mission must lie entirely within the acceptable solution space: it is bounded by professional, legal and ethical considerations. It directs action in foreseen circumstances (explicit intent) and guides actions in unforeseen circumstances (implicit intent). Commander's explicit intent is a statement of the military mission outlining a desired military outcome with the effect of initiating action among subordinates. Implicit intent includes a number of additional assumptions – embedded and unstated underlying and informing the explicit intent and is the result of dialogue and socialization. Implicit intent guides subordinates in interpreting purpose and implementing explicit direction. Implicit intent includes a hierarchy of goals. Common intent¹¹ is the sum of shared explicit intent plus

¹¹ Verdon, J., Forrester, B. (LCdr) & Tanner, L. (2007). Transformation in the CF. Understanding the Impact of Network Technologies on the Design of Work – Social and Peer Production. Director General Military Personnel Strategy. Technical Memorandum for DGMPS.

operationally relevant shared implicit intent. Establishing common intent is a military's organization's primary means for achieving coordinated action. The function of control is to enable the creative expression of will and to manage the mission problem in order to minimize the risk of not achieving a satisfactory solution.

2.6 Decision-Making Domains

A number of decision making models have been proposed by the different research communities. JCDS 21 has developed a unified framework (Figure 8) which illustrates the fundamental elements, provides common context, and presents an integrated vision.¹² The model developed around four layered domains: cognition, knowledge (information), organization and physical (observable effects):

- *Cognitive or psychological domain*: this domain is central to the JCDS 21 framework. It assumes that a decision can be characterized as a cognitive or psychological construct guided by a will and influenced by circumstances. There are many descriptive models which have been developed to understand and prescribe how human cognition deals with decision making.
- *Knowledge domain*: the proposed framework avoids the information versus knowledge debate and simply asserts that decision making is nourished by knowledge (information) and articulated as knowledge (information). While specific representations of information flow may be rare, many existing models describe the information entities that are handled and exchanged during a decision making process.
- *Organizational domain*: humans are inherently social animals. Institutional constructs are important. Decision making is based, justified, supported and legitimized by military organizations or, in a larger context, by the government or an international political body. Information flows within organizations to support decision makers and decision makers exercise Command through organizations. Many models have used staff processes and/or roles & responsibilities to propose descriptive, normative or prescriptive ways to describe decision-making.
- *Observable effects domain*: the JCDS 21 framework focuses its attention on decisions leading to observable outcomes. The outer layer represents this sphere where kinetic and non-kinetic effects can be discerned. Many models describe the decision making process in terms of interaction of complex intelligent entities and some, like participative decision making and democracy, propose methods to integrate the environment of the decision maker into his decision-making (EBO being a good example of a holistic approach).

In sum, the cognitive or psychological domain is guided by will and shaped by perception. The knowledge domain informs decision making. It is supported by organizational structure

¹² Guitouni, A. & Wheaton, K. (2006). An Essay to Characterize Models of the Military Decision-Making Process, 11th ICCRT Symposium, Cambridge UK.

and culminates in actionable outcomes.¹³ While there is no universal model characterizing effectively the complexity of military decision making, this representation is useful as it offers perspective on model options and situates subordinate initiatives. This framework can be mapped around the fundamental functions / stages of the decision making process described earlier: perception (observation), understanding (orientation/awareness), decision and action.

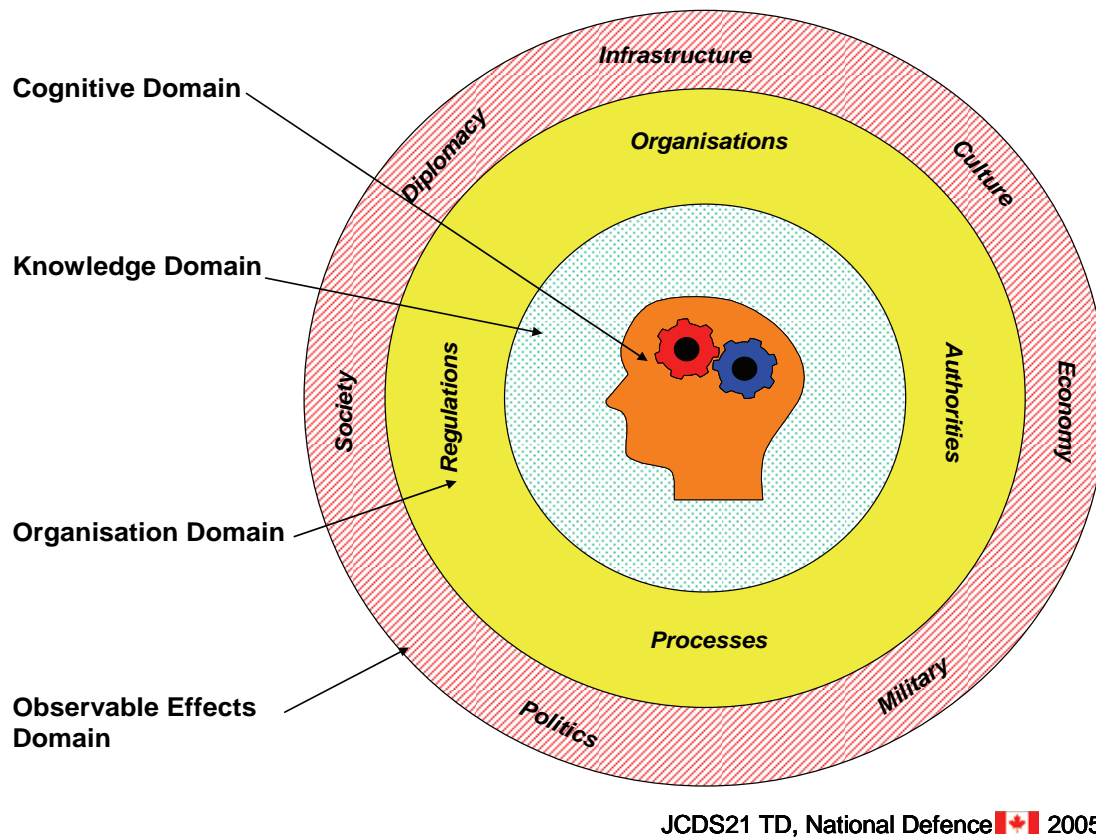


Figure 8: JCDS21 Decision Making Framework (Guitouni & Wheaton, 2006)

¹³ A knowledgeable reader will note that these align closely with the four domains in the NEO framework i.e. Physical, Information, Cognitive and Social. *Net Centric Operations Conceptual Framework* Version 1.0, Evidence Based Research, Vienna, Virginia, November 2003, pg. 11.

3 Overview of CF Decision-Making Processes

3.1 CF Decision-Making Processes

3.1.1 Organizational Levels

Systems engineering emerged as an attempt to model system behaviour. Increased specialization and deeper integration led to a “blurring” of traditional boundaries, and an effort to extend system engineering and treat large enterprises as systems-of-systems. It also led, in turn, to the realization of the limits of linearity and recognition that such enterprises might also be treated as complex adaptive systems, sensitive to initial conditions and to emergent behaviour. Equally important, system-of-systems engineering highlighted the importance of boundary explorations. Nesting is always a challenge. Command and Control is a scalable concept. The functions described can be applied equally at the enterprise and individual levels. Although the traditional distinctions between geostrategic, strategic, operational, and tactical levels may be “blurring” in practice, they remain embedded in CF doctrine and structure, and they do provide a useful framework for developing an operational concept.

DND provides input to the formulation of the national, geo-strategic policy. Internally the Canadian Forces are organized along strategic, operational and tactical lines. National Defence Headquarters (NDHQ) operates at the strategic level and is responsible for contributing to national policy formulation and for overseeing departmental execution. The latter involves establishing CF objectives, roles and responsibilities, rules and constraints, and progress monitoring systems. The 2005 Defence Policy Statement noted that key enablers to CF transformation included adopting a fully integrated approach to operations, improving inter-departmental coordination and updating C4ISR capabilities.¹⁴ Subsequently a unified national command structure was introduced and efforts were initiated to enhance liaison with domestic peers and partners. Concurrently, a clearer distinction has been drawn between Strategic and Operational Command and a Strategic Joint Staff (SJS) was established to provide Strategic Level Decision Support. The Strategic Joint Staff are organized along functional lines with 4 Directorates responsible for Operations, Plans, Requirements and International Liaison. The Strategic Joint Staff focuses on enterprise wide orientation and it is supported by the National Defence Coordination Centre. At the same time that the Strategic Joint Staff was developed, Canada Command, one of the four Operational Level headquarters, was also established.

¹⁴ Government of Canada, Canada’s International Policy Statement: A Role of Pride and Influence in the World: DEFENCE, 19 April, 2005.

3.1.2 Intelligence Preparation of the Battlefield (IPB) and the Operational Planning Process

The Intelligence Preparation of the Battlefield and OPP are designed to be complementary and iterative processes. IPB is the name given to the analytical process used by Joint Intelligence staffs to produce assessments, estimates and other intelligence products to support a Commander's decision making. The intent is to: "1) identify significant facts and assumptions about the battlespace environment; 2) assist a Commander and staff to visualize and assess adversary capabilities and intent; 3) identify strategic and operational centres of gravity; 4) identify the most likely adversary COAs; and 5) focus initial intelligence collection and production".¹⁵ This can be viewed as corresponding to the left side of the TIM 08 Model previously discussed (Figure 5).

Since the CF considers Command and Control to be its most important activity, the OPP is described in the CF doctrine in detail. Figure 9 imparts a sense of the systemic interaction and accords with the Decision-Making Model introduced previously (Figure 8). In practice, the logic sequence (Initiation, Orientation, COA Development, Development and Plan Review) is followed, but may be accelerated if required. This has led to the realization that a distinction can be drawn between deliberate and reactive planning, and between routine and contingency operations.

¹⁵ Guitouni, A. & Wheaton, K, Military Decision-Making Process and Effects-Based Operations Concepts: A Comparative Study, Lessons Learned and Implications, Working Draft.

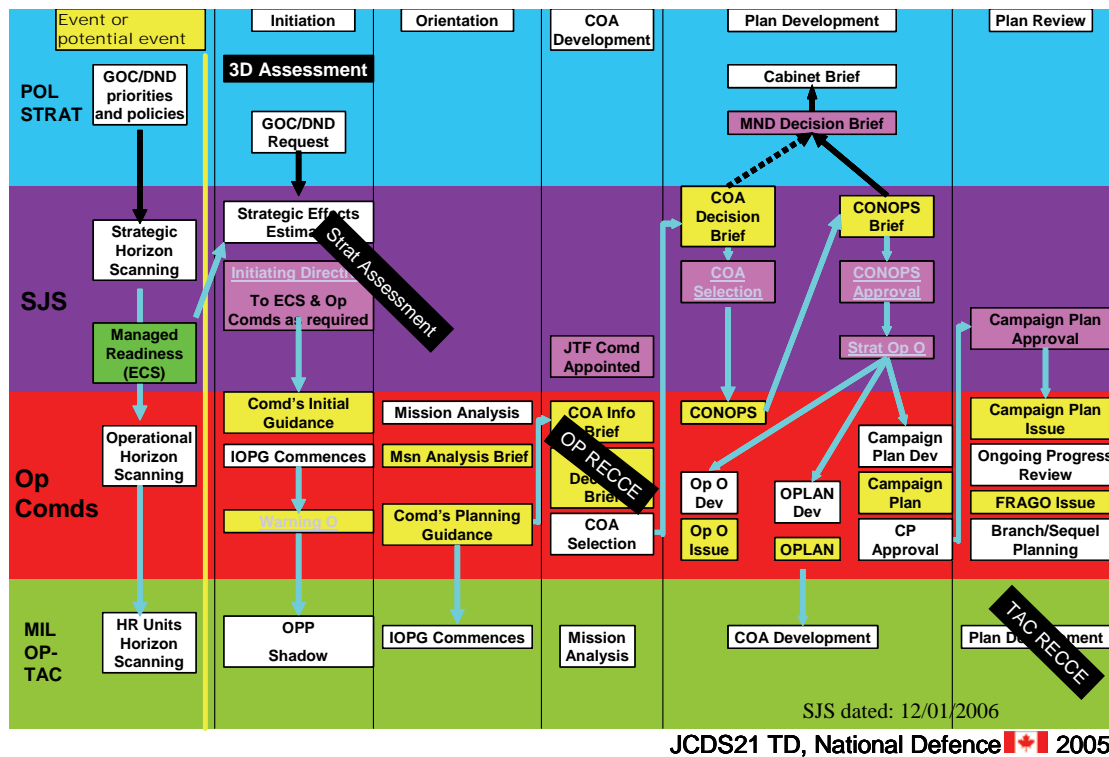


Figure 9: Planning and Decision Making Process

3.1.3 Continual Planning

A dramatic shift in operational tempo followed the Cold-War and still persists. As a result it has become increasingly impossible to draw a firm distinction along classic staff lines between operations and plans. These are no longer (even if they once were) discrete processes. Operations in the 21st century have become analogous to continuous planning and planning and operations have grown into a single integrated process. In concert, the pace of environmental change has also necessitated frequent review and update of contingency plans, which has Process, Organization and Technology implications.

Within DND, a meaningful distinction is now drawn between strategic/long range and operational/nearer term planning. One benefit is that this arrangement aligns much more closely with non-military staffs (i.e., typically Incident Management Operations Staff focus on the next 24-48 hours and Planning Staff focus on 24 hours plus). There is no mature strategic/long range planning equivalent.

3.1.4 Deliberate/Routine/Crisis Planning

Delineation can be drawn within Continuous Planning. Analysis suggests that “planning” can be characterized as Deliberate, Routine or Crisis. Deliberate planning would include preparations for a major event/scheduled activity such as the 2010 Olympics, or a state visit (i.e., a known event/anticipated tasking). Routine planning involves oversight of minor “standard” operations and day-to-day activities, including Managed Readiness. Typically, in

the case of routine operations, the assigned unit has been organized and equipped for the mission and will draw on established operating procedures and standing C2 arrangements. Crisis planning is conducted in response to an incident or unanticipated tasking when time constraints and/or a prevailing threat require urgent reaction. Although prior work may inform and facilitate the preparation of contingency plans, there is no immediate staff solution.

An unrelenting operations tempo is such that organizations seldom have prolonged pause but tend merely to transfer their focus. Resources are continually consumed and replenished/reconstituted. As only a single resource pool exists, there is a requirement to integrate all three sorts of planning so that temporal perspectives (time slices) are available to support a streamlined ability to arbitrate, allocate and relocate resources amongst competing demands.¹⁶ This continuous integrated planning cycle functions on more than one level and is supported by dispersed headquarters staffs working in different time zones. Hence a future decision-support system must provide for shared work spaces and asynchronous collaboration.

3.2 Case Study: Canada Command's C2 Structure

Canada Command located in Ottawa, was established in February 2006, and was assigned operational responsibility for the conduct of all domestic CF operations. CanadaCOM is supported by 6 Regional Joint Task Forces and associated Headquarters.

3.2.1 Higher Authority

From CanadaCOM's perspective, the key nodes on the strategic level are the Chief of Defence Staff (CDS)/Strategic Joint Staff and the National Defence Command Centre/Joint Information and Intelligence Fusion Capability. During a Domestic Operation, the Strategic Joint Staff will focus on providing support/incremental sourcing and inter-governmental/inter-departmental coordination. The NDCC/JIIFC will focus on generating and sustaining Departmental situational awareness.

Establishing CanadaCOM served notice that Canada was to be deemed a single operational theatre. The intent was to provide an internal and external focal point for planning and oversight of operations and to improve the Canadian Forces' the ability to mobilize and deploy resources in response to a domestic crisis. Only in the event of an armed invasion can DND anticipate being designated the Lead Department and CanadaCOM charged with coordinating the response; however this remains an improbable scenario. More likely, as fires, floods, and ice storms of the past decade attest, CanadaCOM will find itself in a supporting role in response to a natural disaster or pandemic, or a terrorist incident. The procedures for providing Joint Task Force 2 support to the Royal Canadian Mounted Police (RCMP) are well established, and the Special Forces are trained specifically and well equipped for this mission. There are also constitutional limitations/legal constraints and

¹⁶ Gabreski, T.L. (MGen USAF), Leftwich, J. (Col, Dr.), Tripp, R (USAF, Ret'd), Roll R.Jr. & von Hoffman, C. (Maj. USAF). (2003). *Command and Control Doctrine for Combat Support*, Air & Space Power Journal.

cultural inhibitions which constrain domestic employment of the CF. CanadaCOM faces unique challenges.

Given the primacy of the role, the CF is organized, equipped and trained to defend Canada and protect and advance Canadian interests (i.e., this mandate drives operational requirements. Operations can be characterized as Routine or Contingency). Routine Operations are planned in advance and typically have standing, well rehearsed Tactics, Techniques and Procedures (TTP) (including Rules of Engagement [ROE]). Decision rights are pre-negotiated. Conversely although existing Contingency Plans may determine the response, Contingency Operations require adaptation on short notice. CanadaCOM will require asset visibility¹⁷, a responsive modelling and simulation (M&S) capability and effective collaboration with partners. Command and Control may be one of the few areas in which CanadaCOM requirements will define CF requirements. Although there are few if any absolute goals which can be used to frame the “Level of Ambition” in a domestic Humanitarian Assistance scenario, the CF will be expected to mobilize available resources and support a call for assistance promptly. An appreciation of asset availability and immediate dialogue will be necessary. Furthermore, while expectations as to how many personnel will be employed may be moderated in light of concurrent deployments (there will be an expectation that everything possible will be done), the government and public will likely be less forgiving of procedural and/or technical difficulties which preclude coordinating efforts and making full use of available resources. This imposes a challenge given the number of stakeholders.

3.2.2 Peers and Partners

The key external actors at this level include US Northern Command, Public Safety (PS) Canada/Government of Canada Operations Centre (GOC), the RCMP/National Operations Centre, and Industry Canada (IC)/Emergency Telecommunications Operations Centre. In lieu of filtering information through the NDCC, this CONOPs proposes establishment and exploitation of a CIE. The SJS/NDCC is charged with monitoring both domestic and deployed operations; the partners cited above are preoccupied with the former. Key underpinning precepts of the draft Federal Emergency Response Plan are the notions of functional responsibility and interdepartmental/cross-agency information sharing. For example, Industry Canada will coordinate communication sector inputs to situational awareness.¹⁸ It is noteworthy that the only Emergency Support Function assigned to DND is Logistics Operations Management. This underscores the importance of establishing a government wide CIE. CanadaCOM will require access to this broader information to draw from to inform decisions and to record inputs received through the internal chain of command. Among the associated issues to be addressed are multi-security caveat access, tailored visualization and CIE governance; the former is uniquely problematic. Many Other Government Departments (OGD) peers have no requirement to see classified documents and are not cleared to do so. Access to caveat documents is intentionally restrictive. By definition no international Partner should be given access to “Canadian Eyes Only” material. Individual

¹⁷ CDM Technologies Inc. Joint Decision-Support System for Tactical Logistic Planning and Coordination. http://www.cadrc.calpoly.edu/pdf/Loggy_Brochure.pdf. Accessed October 10, 2007.

¹⁸ Federal Emergency Response Plan, Volume 1 Draft 4, September 2006.

accreditation /sign on offer only a partial solution. In a crisis allowance must be provided for trade offs to be made (i.e. there may be occasions when near term requirements trump long term security). In such circumstances, time will be of the essence and effective CIE governance will be critical.

*An Emergency Management Framework for Canada*¹⁹ identifies four distinct functions. While the DND/CF has some responsibilities pertaining to Prevention and Mitigation through to Recovery, the prime focus is Preparedness and Response. The distinction between Preparedness and Response is significant. While it is impossible to fully anticipate events and no plan survives contact with the enemy, it is equally true that there is considerable value in planning. Planning, the process (and modeling, experimentation and simulation) can serve to highlight doctrinal shortfalls and equipment incompatibilities. More importantly, it can provide shared insights into competencies and promote trust. Preparedness is an integral part of the National Security Strategy and the Chief of Defence Staff's vision, an often overlooked component to any CONOPs and a vital contributor to effective crisis response. Collaborative planning and periodic exercises should be conducted to identify and rectify (insofar as possible) interoperability challenges, share tactics, techniques and procedures, and inventory resources and mutual assistance agreements should be developed before facing a domestic humanitarian crisis. A gap analysis and Concept of Operations can be used to support development of a Preparedness strategy by highlighting "centres of gravity" and shortfalls, and identifying mitigation methods.

CanadaCOM will also have to maintain close liaison with CF Peers (e.g., Canadian Expeditionary Forces Command (CEFCOM), Canadian Operational Support Command (CANOSCOM) and Canadian Special Operations Forces Command (CANSOFCOM). In an emergency, Forces may have to be drawn from outside CanadaCOM, perhaps even withdrawn from external exercises. Force Generation coordination may prove as important as Force Employment. CanadaCOM may require reach back to the Environmental Chiefs of Staff to ascertain and/or accelerate readiness. CANOSCOM has the responsibility to provide operational level support to CanadaCOM and has a nationally mandated responsibility to coordinate movement of relief supplies and personnel into an affected area. Likewise Air Tasking arrangements are unique. CanadaCOM exercises Operational Command of CF air assets employed for domestic operations through the Winnipeg based Combined Forces Air Component Command (CFACC). The success of these types of arrangements is contingent on the ability to share information and advice with superiors and provide direction to subordinates.

Collaboration with Partners and Peers is an obvious prerequisite for success. Clearly collaborative planning tools are needed. Once a mission is launched the operational tempo will likely require constant adaptation. The distinction between deliberate/contingency and reactive/continuous planning noted earlier has organizational implications which need to be explored, as does the issue of establishing and sustaining trust between dispersed teams.

One of the major challenges will be to create and sustain CIE compatibility. Technological advances and differing organizational rates of introduction may compromise CIE coherence. A clear distinction can be drawn between internal CIE configuration which DND can largely

¹⁹ Public Security and Emergency Preparedness Canada: An Emergency Management Framework for Canada.

dictate and interoperability with Partners which DND may be able to influence but can not control. The first priority is to address establishment of an internal CIE. Carnegie Mellon proposed a Levels of Information Systems Interoperability (LISI) Model which distinguishes 5 levels ranging from Enterprise (interactive manipulation) through to Functional (separate data and applications) and Isolated (non-connected). Clearly, DND should aspire to the highest level internally, to provide an integrated Command and Control system. Subsequent priority would seem to be CONOPs related: should connectivity to Strategic, Operational or Tactical Level Headquarters take precedence? A strong case can be made that the Regional Level Headquarters should take priority. Arguably, time and detail is more critical at the coal front (consistent with Net Enabled Operations).

3.2.3 Subordinates Structure

CanadaCOM is supported by six Regional Joint Tasks Forces (Figure 10). Canada Command Direction for Operations (CCDO)²⁰ notes that legal regimes differ (e.g., Assistance to Law Enforcement Agencies versus Aid of the Civil Power, and a distinction can be drawn between requests for Immediate Reaction Forces, General Duty troops and unique, specialist skill sets such as the Chemical, Nuclear, Biological, Radiological and Nuclear (CBRN) teams). More significantly, the CCDO espouses a decentralized approach, tables an intent to provide Regional Commanders with as much autonomy as appropriate (particularly for routine operations) and encourages liaison with local authorities. This is consistent with the philosophy behind the Emergency Response Planning (ERP).

²⁰ *Canada Command Direction for Domestic Operations*, Interim Version 1 (01 Feb 2006).

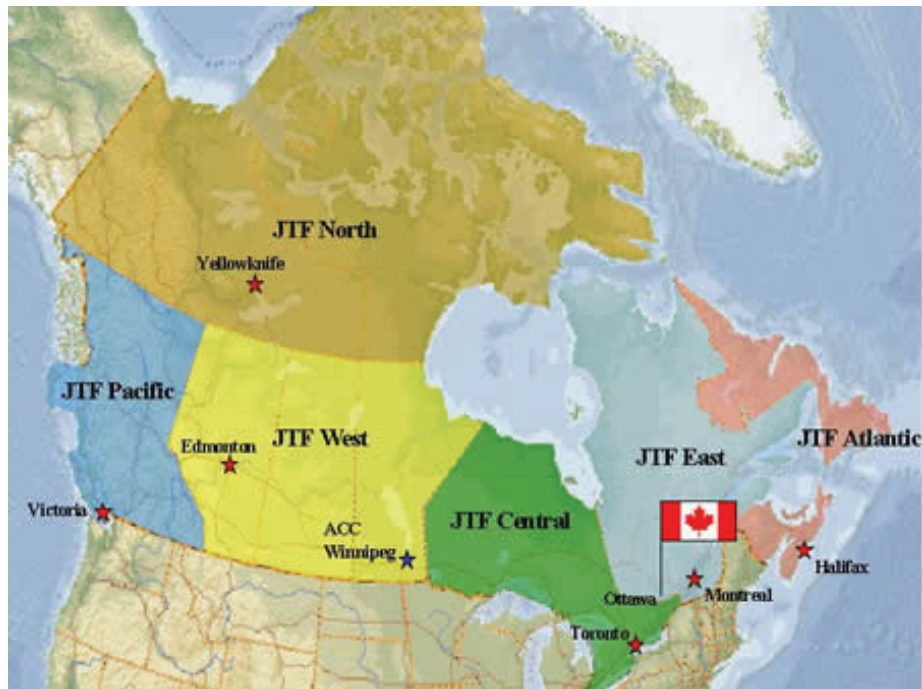


Figure 10: CanadaCOM Structure (http://www.canadacom.forces.gc.ca/en/rjtf_e.asp)²¹

A key differentiator between traditional military mission planning and domestic disaster relief is the “top down” versus “bottom up” orientation. Most Emergency Response Management Plans (ERMP) are based on the U.S. Incident Command System (ICS) which outlines a hierarchical structure starting at the Site Level. Only as resources prove inadequate are progressively higher levels (regional, provincial, and federal) of mobilization assistance activated. The Regional Joint Task Force Commander is well positioned to anticipate any request and offer advice as the formal call for assistance is staffed. This underscores the requirement for a CIE and shared awareness, and for provision to be made for planning processes to be inclusive and issue networks/communities of interest catered for.

The ICS organizational construct is scalable and applicable to all levels and provides a departure point. Although application may vary slightly, the command and control functions distinguished tend to be fairly consistently represented and are easily mapped to the military manning schema (i.e., within DND/CF):

- Incident Command = Commander CanadaCom;
- Operations Section = J3;
- Planning Section = J3 and J5;
- Information & Intel Section = J2;
- Logistics Section = J4 and J6; and
- Finance/Admin Section = J1 and J8.

²¹ Website accessed August 15th, 2007.

The “continental” J1-9 in turn provides the departure point for CF Command and Control organization, and facilitates establishment of communities of interest.

Communities of interest exist at all levels but are perhaps particularly significant at the regional and tactical levels where intent has to be translated into activity and there is increased decision urgency. Prior modeling of the Operational Planning Process cycle by JCDS 21 suggests that the Command and Control system must accommodate a series of internal and external exchanges. CanadaCOM J1 staff may review personnel commitments with superiors, partners, peers and subordinates (vertical integration) prior to functional Joint Staff meetings (horizontal integration). This assures situational awareness alignment, shapes option development, informs risk assessment, and accelerates plan production. The insights garnered may facilitate execution.

External communities of interest, including the public, will be equally important in many instances. In a system-of-systems world, an individual’s span of control may have shrunk but his/her span of influence has likely grown. This reinforces the requirement to ensure that the Commander’s intent is widely understood in order to avoid conflicting messages, to make independent decisions to achieve an objective to ensure that all team members are encouraged and are given the means to provide input into the knowledge base. As “security” has been associated with a broader meaning, this has necessitated partnerships not only between arms of government but between public and private domains. Past bounds are blurring. The Government and Canadian Forces rely heavily on commercial infrastructure, particularly in the domestic domain. Companies and military contractors are being used to augment the CF and even domains such as ISR have increasingly become privatized. Trust, confidence and working relationships need to be established. In this new world order, persuasion based on common objectives and shared situational awareness may prove potent.

The Regional Joint Task Force Commanders are likely to be at the vortex of the disaster relief efforts, a “local” DND/CF presence juxtaposed at the point where regional /provincial resources are overwhelmed and federal resources are applied. Although based on fixed headquarters, their requirement for a portable decision support aid would likely exceed that of Commander Canada Command. In the absence of a fully integrated CIE, reliance will default to CF Liaison Officers co-located with Partners and Peers. They will require insight to Departmental plans and operations and connectivity to the Regional Joint Task Force Commander (i.e., ideally a deployable portal allowing access to the CF CIE and direct communication to the Commander and staff). Lastly, it is not difficult to envisage circumstances in which a deployed collaborative planning facility would prove a useful addendum (e.g., in preparation/conduct of a major event, or as a mission rehearsal or lesson learned centre).

3.2.4 Environment

Finally, as suggested in the Integrated C2 Model (Figure 6), environmental factors are also influential factors in decision making. External events often serve as a stimulus and the situation context may also be important. There are numerous historical examples describing how chance encounters/engagements prejudice a Commander’s judgment. Fatigue and physical/psychological comfort may also play into decision making.

4 Initial Decision Support Gaps Analysis

This CONOPs reflects considerable prior research and definitional effort by the JCDS 21 team. This section provides a brief synopsis of these efforts.

4.1 Characterization of Complex Situations

A Characterization of Complex Situations was undertaken to support JCDS 21 project definition. Deliverables included reports on Emergency Response procedures, scenarios, asymmetric and terrorist threats, and strategic-level information and task flows. The project confirmed that the JStaff were engaged, as a matter of course, in planning, executing and sustaining operations in complex settings with multiple stakeholders.²² Accordingly, at that time, the DND/CF were realigning their strategic operating concepts to better reflect Military Operations Other Than War (MOOTW) and to function effectively in a Joint, Interagency, Multinational and Public environment. The Operations Planning Process served as the reference for discussing and developing High Level Activity Models depicting staff practices. The Characterization of Complex Situations focused on DND's role in the event of a response to domestic incident. The US Department of Defense's Architecture Framework (DoDAF) was used and overarching concepts, key nodes and activity sequence models developed. The rigor an architecture-based approach offered proved useful. The process disciplined data collection and structure; the Operational View-2 (OV) (Figure 11) illustrates this point. It depicts key organizational authorities and process (input/output) dependencies. It was found that the JStaff and Liaison Officers play key roles providing strategic and operational level decision support and links to the tactical level. Further, it was concluded that the OPP provides sound doctrinal guidance but does not prescribe a linear process (the sequence of activities is not as important as the priority) and, equally importantly, most OGDs do not have an equivalent process; hence, process integration is required. The Characterization of Complex Situations exposed the challenge and identified the requirement for process integration.

²² In a massive fire near Nanticoke, 346 organizations converged; this included 27 Federal Government, 25 Provincial Government, and 10 Regional agencies; 7 Local Government Departments, 31 Fire Departments, 8 Voluntary Groups, 41 Church/Hospital/Schools groups, 4 Utilities, and 52 Private Sector players (Quarantelli, E.L. *Disaster Related Social Behaviour: Summary of 50 Years of Research Findings*, Disaster Research Centre University of Delaware; pg 2.

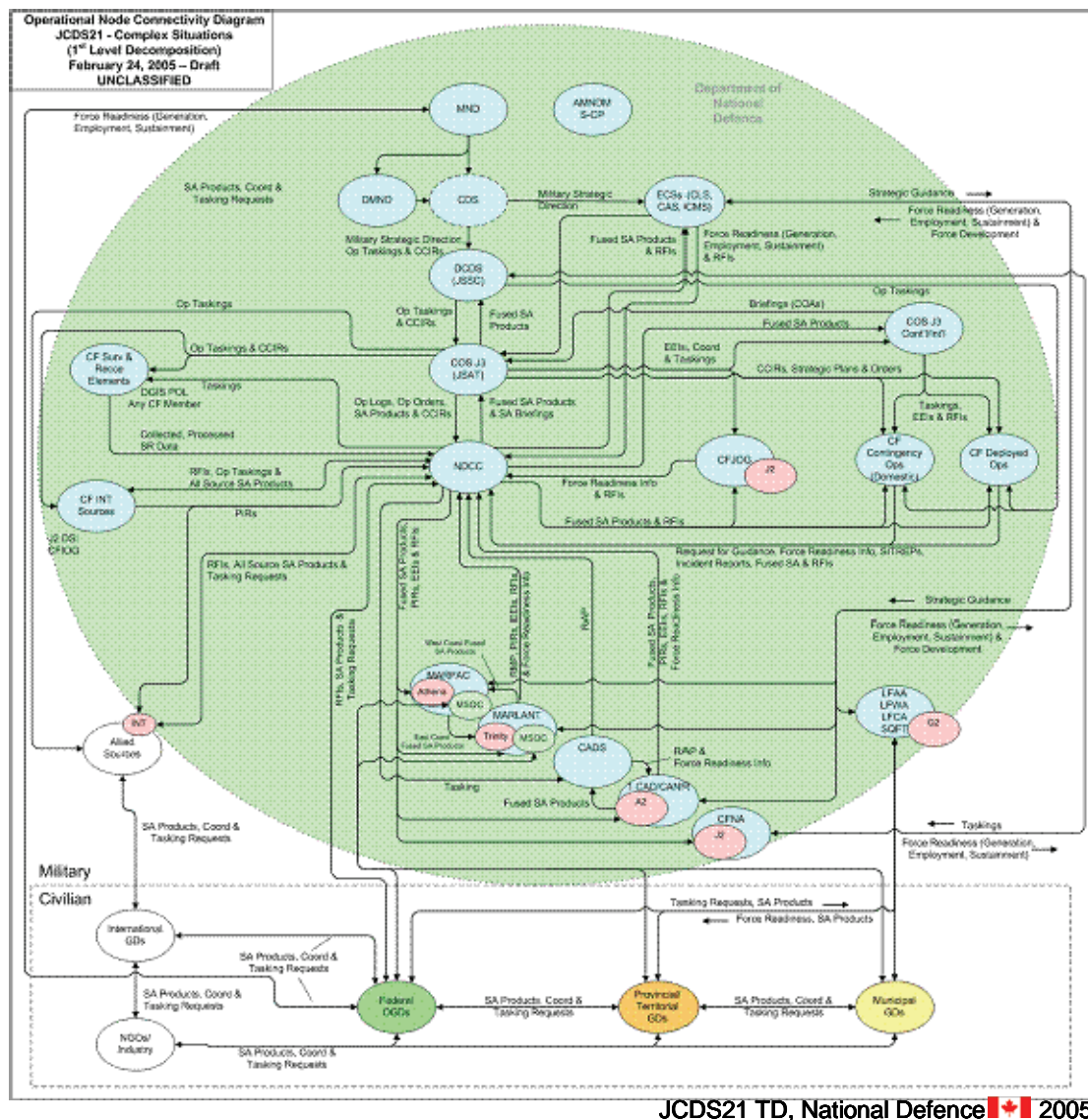
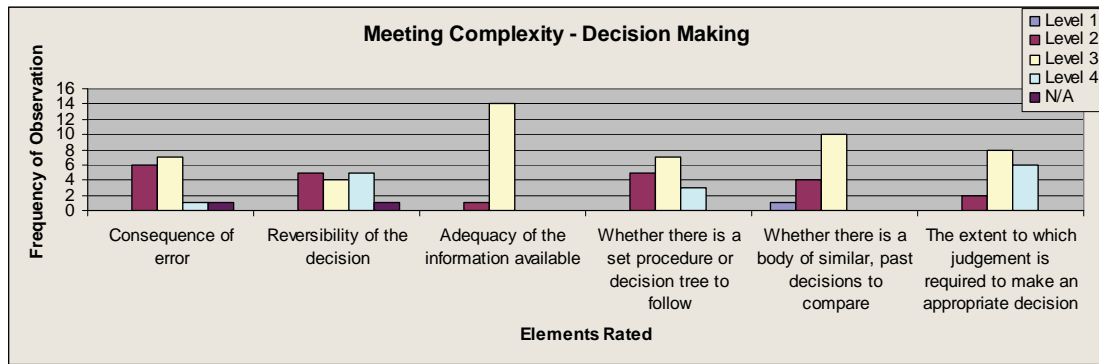


Figure 11: Operational View-2

4.2 JSTAFF Front-End Analysis (Functional Area and Needs Analyses)

Expanding upon the preliminary stage-setting work, JCDS 21 undertook to develop an understanding of existing staff planning and decision support activities and conducted Functional Area and Needs Analyses. Data collection and analysis activities were conducted between January and October 2005; a structured approach which included a review of the literature, observations and interviews was adopted and daily and mission specific activities were observed. Data collection focused on decision making, problem solving, finding information, collaboration, and I2 analysis.

The study concluded that the Joint Staff can be viewed as a standing group of Subject Matter Experts (SMEs). Their roles and responsibilities, and products and interactions were documented, and the flow of events associated with two illustrative cases studies (one continental and one international) was examined. Subsequent effort went into investigating requirements definition, performing a detailed analysis of observation data and identifying the key factors affecting the staff's ability to discharge their responsibilities. A Gap Analysis was conducted as part of Front End Analysis (Greenley, Baker, & Cochran, 2006) and is particularly relevant to this CONOPs. The Gap Analysis included consideration of complexity and risk dimensions. A representative sample of the data is shown in Figure 12.



JCDS21 TD, National Defence  2005

Figure 12: Meeting Complexity – Decision Making

The results of the Gap Analysis affirmed that:

1. Extracting and processing information is more complex than discovering information;
2. Defining the solution space was more complex than defining the problem; and
3. The most complex elements in decision making include obtaining adequate information and locating set procedures/prior decisions which might serve as a reference point for elaboration and/or comparison and applying judgment.

This highlighted the need for tools to assist in knowledge mining and situational analysis, and in developing templates/decision trees based on past practices. The risk dimension survey determined that:

1. In the majority of cases, decisions/solutions were needed within a week;
2. Control of resources is constrained by the number of external stakeholders;
3. Face to face meetings were more crucial to mission planning than to the OPP product generation; and
4. Routine meetings focused on the longer term (typically more than one month). Contingency operations would likely have been preoccupied with more immediate timeframes.

This data highlighted the requirement for a Command and Control system to include total resource visibility and to accommodate collaborative planning/collective decision making. It

identified that it is equally critical for a Command and Control system to facilitate temporal mixing (the ability to integrate immediate and longer term planning).

The Needs Analysis included communications profiling and found:

1. Although most decisions were objective, provision should also be made to accommodate intuition. This has substantive implications as many decision support aids are deterministic while training/education/selection programs tend to concentrate on developing and assessing subjective judgment; and
2. Oral communication was the most common medium across all observation forums and there was extensive use of PowerPoint.

This data provided the basis for the Functional Area and Needs Analyses and determination of Command and Control “Capability Packages”, as illustrated in Figure 13.

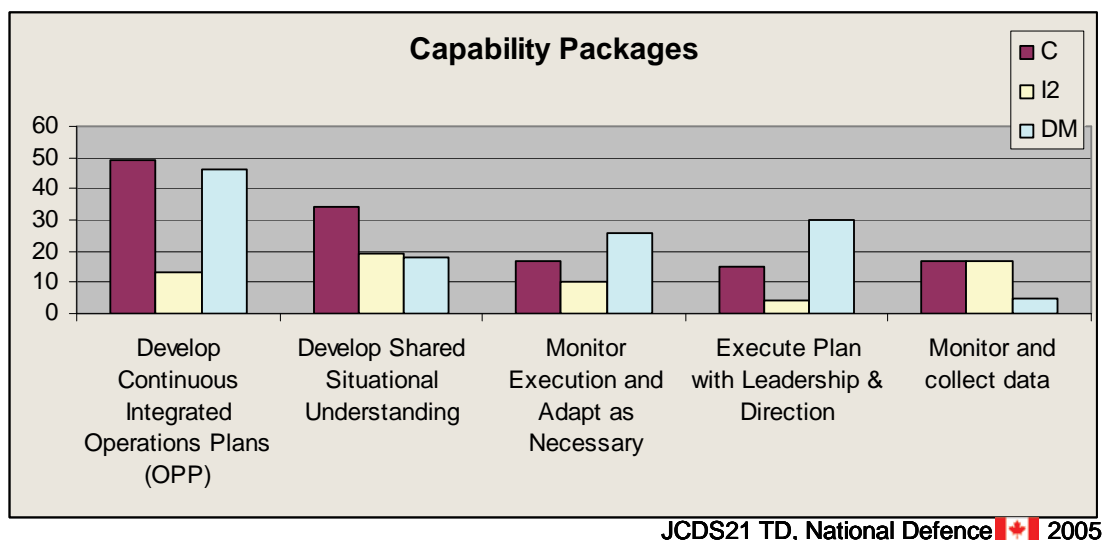


Figure 13: Capability Packages and their Relationship to Decision Making, Collaboration, and Information and Intelligence Analysis

Although the JSTAFF Front End Analysis study (Greenley, Baker & Cochran, 2006) was conducted 2 years ago, before the new commands were established, cultural and technological gaps were identified, which are also thought to still exist today. The previous study also noted that Command View (CV) has evolved significantly; more use is likely being made of the portal, and liaison officers can be a valuable resource but must be linked if the potential they offer is to be exploited. The findings provide emphasis to the usefulness of graphic presentations (i.e., the importance of visualization and requirement to progress beyond PowerPoint to a more sophisticated staging tool which allows for near time aggregation and distillation).

These results, in essence the Functional Needs Analysis, were presented and discussed at a workshop. They provided the genesis of a gap analysis and shaped development of the JCDS21 program and work breakdown structure (WBS) (i.e., provided a baseline for

structuring elements of a future Functional Solution Analysis). Table 1 outlines the gaps identified and relates them to JCDS21 sub-project groupings.

Table 1: Gap Identification and Relationship to the JCDS 21 Sub-Groupings

Work Breakdown Elements (WBE)	GAP	FAA Capability Package(s) Affected
3.1 Investigate JIMP paradigm Information Exchange Challenges	<ul style="list-style-type: none"> • Difficulty exchanging information and communicating in JIMP environment with dynamic streams and issues. 	1. Monitor and collect data; 2. Develop shared situational understanding; and 5. Monitor execution and adapt as necessary.
3.2 Collaborative Working	<ul style="list-style-type: none"> • Lack of tools to facilitate collaborative working; • Need to execute in sync with other stakeholders; and • Operations and resource management need to support self synchronisation. 	2. Develop shared situational understanding; and 3. Develop continuous integrated operations plans.
3.3.1 Using Advice and Integrating Information in Human Decision-Making	<ul style="list-style-type: none"> • Need support for the individual cognitive process (influenced by individual experience and knowledge) to ensure appropriateness and effectiveness of decision making; • COA development feeds decision makers and strategic guidance feeds COA development – interdependencies need to be realised; • No doctrine exists on integrating information to support decision making; and • Creation of such doctrine could identify factors that lead to improved integration. 	4. Execute plan with leadership and direction; and 5. Monitor execution and adapt as necessary.
3.3.2 Commanders' Decision Making Styles	<ul style="list-style-type: none"> • Need support for the individual cognitive process (influenced by individual experience and knowledge) to ensure appropriateness and effectiveness of decision making; and • Biases from individual knowledge and experience may lead to conclusions to be drawn rapidly without following processes - need to prevent against the impact of circular information, history etc., that reinforces a train of thought and ignore others. 	4. Execute plan with leadership and direction; and 5. Monitor execution and adapt as necessary.
3.3.3 Shared Intent and Shared Situation Awareness Factors	<ul style="list-style-type: none"> • Difficulty developing shared intent with stakeholders in JIMP environment; and • Shared situational awareness needs to be improved to share info across all levels of decision making – strategic, operational and technical. 	1. Monitor and collect data; 2. Develop shared situational understanding; 3. Develop continuous integrated operations plans; 4. Execute plan with leadership and direction; and 5. Monitor execution and adapt as necessary.
3.3.4 Heuristics and Biases in Decision-Making	<ul style="list-style-type: none"> • Few risk assessment processes and tools. 	1. Monitor and collect data; 4. Execute plan with leadership and direction; and 5. Monitor execution and adapt as necessary.

Work Breakdown Elements (WBE)	GAP	FAA Capability Package(s) Affected
4.1 Advanced Knowledge Discovery	<ul style="list-style-type: none"> • Plethora of info sources (structured and unstructured) exist; • No common structure for storage system or accessing information; • User information requirements are huge. • Analysts have to be careful of circular information (i.e., information that started at point A, passed to point B, then to point C and then from C back to A: circular information can appear to confirm information); and • It is hard to recognize and prevent as sources are not always shared as freely as information. 	1. Monitor and collect data; and 5. Monitor execution and adapt as necessary.
4.2 JIIFC Collaborative Knowledge Management Environment	<ul style="list-style-type: none"> • Information is not always organised in a format that enhances collaboration. 	1. Monitor and collect data; and 5. Monitor execution and adapt as necessary.
4.3 Shared Situation Awareness Support	<ul style="list-style-type: none"> • Inability to locate the proper expertise and the knowledge artefacts; • Difficulty to synchronize Battle Rhythms; and • Need to manage dynamics as the situation changes: need an updating mechanism. 	1. Monitor and collect data; 2. Develop shared situational understanding; 3. Develop continuous integrated operations plans; and 5. Monitor execution and adapt as necessary.
4.4 Part 1 Information Fusion/Correlation/Visualization	<ul style="list-style-type: none"> • Lack fusion correlation (don't have resources except at the Knowledge Management level); • Fusion is not only from units/departments but from levels of decision making – strategic, operational and technical; and • Sources of information/intelligence need to be identified to ensure proper representation of all angles. 	1. Monitor and collect data.
4.4 Part 2 Meaningful Representation	<ul style="list-style-type: none"> • Information is not always useful in the format it is obtained in; • I2 analysis must be delivered in meaningful representation with an understanding of users needs; and • Need to focus on people, processes and issues in an operations centre. 	1. Monitor and collect data.
4.4 Part 3 Intense Collaboration Environment	<ul style="list-style-type: none"> • Need to increase collaborative workspace; and • Collaboration is not just about sharing information, there is a need to foster an understanding how each other works. 	2. Develop shared situational understanding; 3. Develop continuous integrated operations plans; and 5. Monitor execution and adapt as necessary.
4.5 JIIFC Information and Intelligence Analysis Support	<ul style="list-style-type: none"> • I2 enablers need to be integrated. 	1. Monitor and collect data.
5.1 Actionable Knowledge Framework	<ul style="list-style-type: none"> • Difficulty identifying components in decision making process; and • Emphasis needs to be made on the quality of the decision, process of decision making and justification of decision. 	3. Develop continuous integrated operations plans; 4. Execute plan with leadership and direction; and 5. Monitor execution and adapt as necessary.

Work Breakdown Elements (WBE)	GAP	FAA Capability Package(s) Affected
5.2 Net-centric Operations Planning and Logistics Management	<ul style="list-style-type: none"> Lack sufficient resource visibility (people, materiel). 	4. Execute plan with leadership and direction; and 5. Monitor execution and adapt as necessary.
5.3 Distributed Decision Analyses and Action Selection	<ul style="list-style-type: none"> Difficulty in identifying what are the critical information elements for decision-making; Difficulty in presenting the information in a way that helps identifying actions to be taken (action knowledge); Difficulty in developing and analyzing courses of action, including resource management, predictive analysis, risk analysis; Command and control structure needs to be coordinated for integrated operations - more holistic; and Virtual collaboration environment to support distributed command is required – consideration that some technologies do not have dual use (i.e., knowledge walls [multiple screens with different views]) that are associated with fixed command post, do not support vertical and horizontal and multi-stakeholder environments. 	4. Execute plan with leadership and direction; and 5. Monitor execution and adapt as necessary.
WBE 5.4 Execution Management in Distributed Environment	<ul style="list-style-type: none"> Delays in change detection or assessment (violation of assumptions in plans being followed, implications to plan not fully understood); Delays during re-planning / Inappropriate replanning (good options overlooked or implications of options not fully understood); and Goal/priority mismatch between levels of command. 	2. Develop shared situational understanding; 3. Develop continuous integrated operations plans; 4. Execute plan with leadership and direction; and 5. Monitor execution and adapt as necessary.

JCDS21 TD, National Defence  2005

The previous JCDS JSTAFF Front End Analysis (Greenley, Baker, & Cochran, 2006) highlighted the challenges the emergent environment poses and provided for a structural decomposition (Capability Packages) and a work breakdown structure. Perhaps equally significant, the project confirmed the requirement for continued research and the advisability of studying the OPP in detail given its role in the staff processes.

4.3 Deductions from the Joint Staff Business Process Modelling

Following the FAA and FNA described in Section 4.2: JSTAFF Front End Analysis, modeling of staff planning, collaboration, information/intelligence analysis and decision making was undertaken. The intent was to capture the associated high level activities between the key players (operational nodes) to establish the baseline for further decomposition and to assist in assessing gaps and deficiencies, validating Measures of Effectiveness and Measures

of Performance, and for designing and analyzing experiments. Use was made of *Case Complete*²³ to capture descriptions of the key actors, their goals and related activities and of *G2/Rethink*²⁴ to develop a rules-driven business simulation characterizing tasks, roles, resources, and sequential actions.

A business process is, in essence, a depiction of tasks and outcomes associated with a business activity. A business process characterizes tasks, roles, resources and sequential actions to be taken to satisfy corporate requirements. Business processes detail the resources and procedures are needed to enable a business to achieve goals and to implement an organizational strategy. The goal of the modeling effort was to capture the main tenets of operations planning at a military headquarters (i.e., Canada Command); that is, to map out the processes required to support an operation that may be undertaken during the course of a domestic operation. The effort involved discovering the “code” for administering an operational headquarters. This proved to be an amalgam of explicitly recorded Standard Operating Procedures (SOP) and doctrinally based Tactics, Techniques and Procedures and a number of tacit (unwritten) rituals, routines and best practices derived from experience.

The project validated the distinction previously made between:

1. Deliberate Planning: The OPP is done in advance as time permits a longer planning cycle in preparation of a mission or suspected mission. Orders may be issued to pre-position resources and to pre-assign roles and responsibilities.
2. Continuous Planning: Activities such as Maintain SA, Situation Report (SIT REP) and RFI are ongoing throughout the event as incidents/missions are directed and monitored.
3. Incident Response (Crisis Contingency / Rapid Response) Planning: Rapid response or contingency operations occur when an unexpected incident occurs that requires an immediate response. In time critical situations, a condensed planning process is followed.

²³ *Case Complete* is a software tool which was used to capture descriptions of the key actors, their goals and related activities. It has a number of attractive features, notably data collection is “user friendly” (i.e., operators can enter a description of responsibilities in simple prose). These goals are then used to generate *Use Cases*. An action connects one actor’s goals with another actor’s goals. Hence a *Use Case* can be thought of as a sequence of interactions relating actors, triggers and activities. *Case Complete* exports the *Use Cases* in XMI format (the standard interchange protocol supported by most UML tools). *Artisan* is another commercially available software package which can be used to generate *Use Cases*.

²⁴ *G2* is an object-oriented development environment designed to support understanding and optimization of dynamic, complex decision support and control applications. It allows model developers to use natural language to express objects, business rules and procedures. This knowledge can be applied to study system performance in real or simulated real time. Hence developers can dynamically model, imitate and visualize business processes to quickly design and test prototypes and explore system behaviour. *G2* is a real-time discrete or event driven simulation software; *G2/ReThink* is a complementary software application which exploits the *G2* engine. A rules-driven business process modeling (BPM) product, *ReThink* incorporates time-sensitive business rules, process modeling and simulation. It enables representation of a business process as it operates today but, more importantly, it has the potential to support the modeling of a service-oriented architecture.

The model concentrated on key business processes associated with deliberate planning. These included:

1. The OPP: The Operational Planning Process was the main focus of the modelling effort. The capabilities of the CF (Command; Act; Sense; Shield; Sustain) were captured as they pertain to C2 using the OODA Loop framework.
2. Request for Information: Inputs such as Government of Canada policy, intelligence products (such as RFI) and task force Situation Reports were modelled as inputs, rather than full processes. The RFI was modelled simplistically to ensure J2/JIIFC representation as inputs to other processes.
3. Collaborative Information Exchange: Command View was used to represent a CIE tool. As a web portal, activities focused on: 1) posting information; and 2) pulling information. Some provision was made for other tools used to facilitate information exchange and communication including email, fax, phone and meetings.
4. Battle Rhythm: The battle rhythm was captured by modelling the Battle Staff meetings associated with executing planning (OPP) and the daily Situation Report process which drives the work cycle.

The JSTAFF Front End Analysis report provides full details (Greenley, Baker, & Cochran, 2006). Full use was made of prior ground work and activity models. Initial efforts involved elaboration of information gathered under auspices of the Characterization of Complex Situations. The PowerPoint depictions (Figure 14, Figure 15, and Figure 16) were developed, validated, and then substantiated in *G2/ReThink*, a business process model software tool. An iterative approach was adopted. The series serves to illustrate how depth is added.

Process Model Focus: OPP

(primary actor: J3 as lead; secondary: Battle Staff members - J1-J9 plus LO's and advisors)

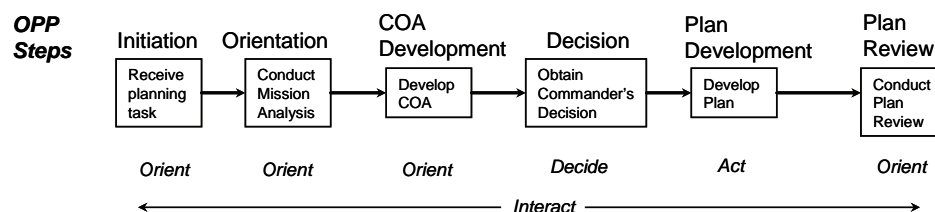


Figure 14: OPP Process Model – Top Level

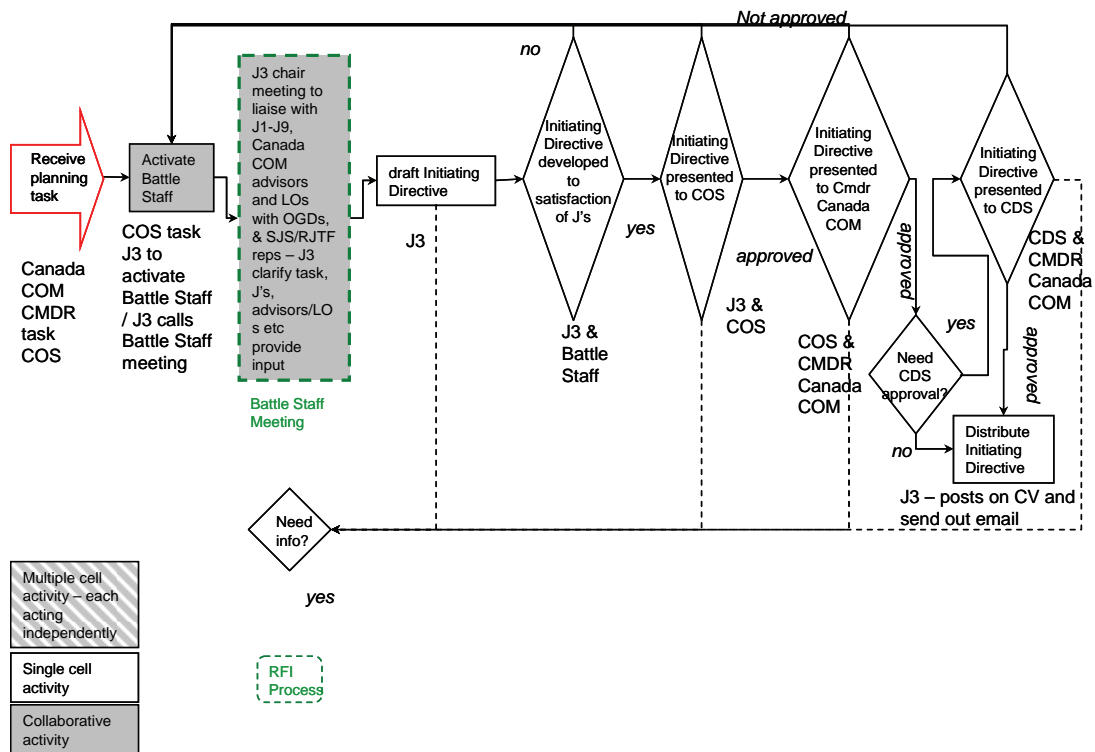


Figure 15: OPP Process Model (OPP Initiation)

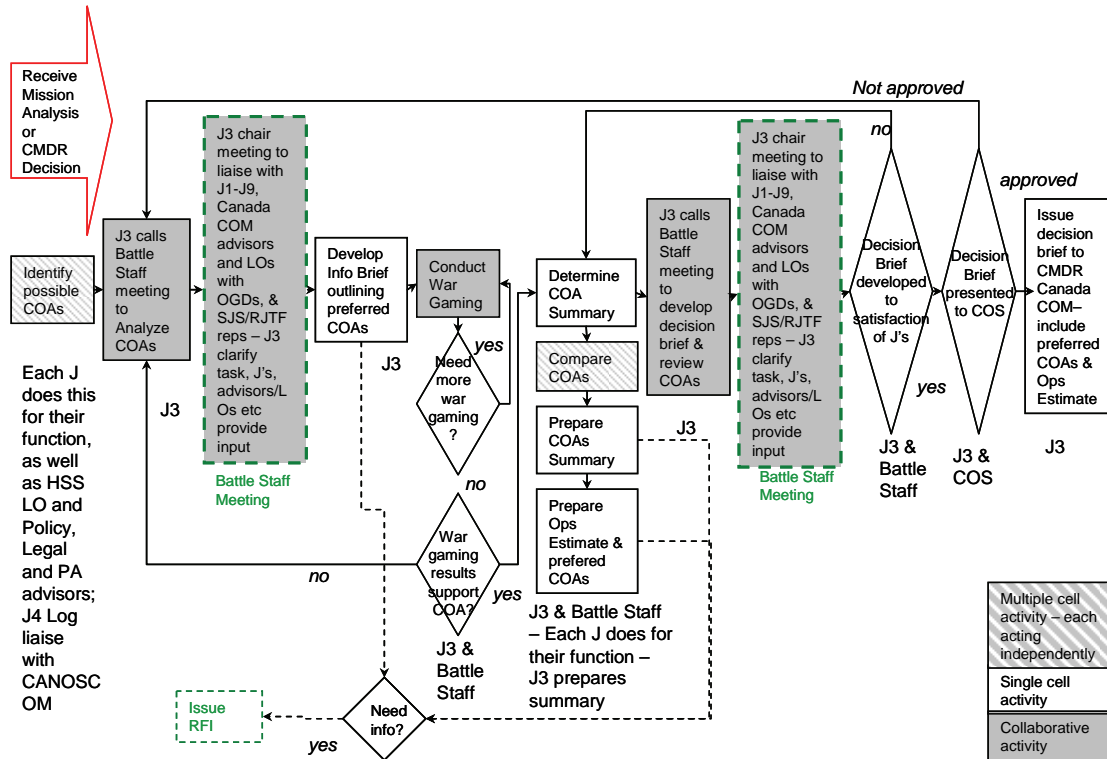


Figure 17: ReThink Model – Receive Planning Task (Orient) Development

Substantiation in *G2/ReThink* was significant for two reasons. First it demonstrated the ability to transition from static DoDAF representations into an executable model. Secondly the *ReThink* model supported exploratory analysis. This remains ongoing work but, for example, the time and resource requirements to support preparation of a routine Situation Report for a major event were modelled. Inputs include procedural delays (with appropriate distribution curves), number of clerks and transmission means (e.g. telephone, fax, electronic mail with associated time delay and accuracy implications). Outputs are displayed in “dashboard” fashion. Simulation allows for concepts, procedural enhancements and organizational changes to be investigated prior to experimentation, and is the logical prelude to constructive experimentation.

4.4 Lessons Learned from ARDENT SENTRY 06 EX

JCDS 21 was privileged to observe a Command Post Exercise (CPX), ARDENT SENTRY, conducted 1-12 May 2006. It was significant for a number of “firsts” including: 1) it was the first large scale multifaceted exercise in which Canada Command participated in; 2) it was the first time that the CF and Public Safety and Emergency Preparedness Canada (PSEPC) collaborated on an exercise of this magnitude; and 3) it was the first time since the inception of US NORTHCOM that the CF participated significantly in a US-led Homeland Security exercise. ARDENT SENTRY provided an opportunity to test innovative Command and Control concepts of operations related to domestic operations and was used to identify

operational requirements and shortfalls. The Exercise also confirmed shortfalls and challenges identified in the JSTAFF Front End Analysis report (Greenley, Baker, & Cochran, 2006).

The exercise objectives included: establishing and maintaining SA, conducting collaborative planning, and coordinating incident management support. CanadaCOM's ability to develop and share a Common Operating Picture and to exploit the OPP and the effectiveness of existing C2 structures were evaluated. A number of events varying in severity and scope as well as occurring in different regions were also introduced to test the C2 structure. Approximately eight to ten scientists from JCDS 21 (across four sites) observed the proceedings and administered questionnaires and interviews.

For the most part their conclusions confirmed anticipated challenges:

- Situation Monitoring, Awareness and Analysis
 - Information sharing is critical and achieving situational awareness a communal responsibility to mutual benefits. “Without early and comprehensive sharing of information from the bottom up (Joint Task Force Atlantic [JTFA] through to Canada Command), the superior Headquarters is limited in its ability to foresee needs of the subordinate formation and to begin pre-emptive or proactive action on behalf of the operational HQ”.²⁵
 - Information and Direction arrives from many sources through multiple communications networks. Multiple (and even redundant) systems can be beneficial and offer options; each has its own advantages/disadvantages in terms of availability, speed, and bandwidth, etc. However choice should not be left to the sender. The rule set must be agreed upon, understood and adhered to. Network convergence and improvement in Standard Operating Procedures are needed to ensure that stakeholders can rely on information being accessible when and where expected.
 - A great deal of information was received through personal or appointment contacts. Procedures and tools need to be developed to assist in integrating information from bilateral/ “off line” communications into the COP.
 - An auto alert function needs to be developed (e.g., ensuring J1-9 staff outside the Joint Command Centre (JCC)/Operations Centres are made aware by watch staffs following receipt of essential information).
 - CF protocol directs that the messaging system serve as the official channel for orders (it proved to be slow and unreliable).
 - Ideally, information would be accessible from a member's workstation. The capability of staff to monitor multiple systems and the requirement for “data mining” (i.e., searching for where information might be posted) must be reduced if not eliminated. Currently there is no system available to catalogue information by

²⁵ Exercise ARDENT SENTRY 2006, Post Exercise Report, June 2006 ; pg. 25.

type or subject on arrival, facilitating discover, retrieval and collation. This was identified as a major issue.

- Timely and effective dissemination of perishable intelligence of immediate operational importance was problematic. This was attributable to the lack of a common “Canadian Eyes Only” communications network.
- There is no one system which allows rapid exchanges of classified information between all Canadian Government Departments.
- The GOC and some OGDs have limited access to secure networks and many external partners lack security clearances. Classified information had to be extracted and filtered before it could be passed.
- Senior participants found Command View to be more of an information sharing tool as opposed to a decision support tool. It is not user friendly/intuitive and only limited training is provided. Updates were not consistent and/or timely and, in many cases, information was not located according to users’ expectations. In summary, the design and content of the screen need to be revisited to satisfy operational requirements.
- The Joint Command Centre serves as an “Information Exchange Broker” and needs to be staffed with sufficient people with appropriate (cognitive and intellectual) skills to support information collation and interpretation.
- Planning
 - In general, extant processes (e.g., RFI, OPP) worked well.
 - Interdisciplinary teams (i.e., Rapid Response Action Planning and a Commander’s Planning Team, Plans Battle Staff and Operations Battle Staff) and functional (J4 logistics, J3 Plans and J3 Ops bullpens) were created underscoring the requirements to ensure a common data set and to support collaboration. These worked well and the establishment of bullpens could provide a model facilitating HQ’s handling of a number of issues simultaneously.
 - ARDENT SENTRY suggested the potential for increased use of contingency plans. This would seem to reinforce the value of Deliberate Planning and indicate a larger role for Modeling and Simulation.
- Direction
 - “Disciplined battle rhythm can dramatically enhance the SA of the Commander and staff.”²⁶ However, while CanadaCOM staff was able to execute the OPP in isolation or in conjunction with JTF HQs, senior participants were unable to synchronize staff activities and establish a battle rhythm with key external partners.

²⁶ Exercise ARDENT SENTRY 2006, Post Exercise Report, June 2006 ; pg. 45.

- Execution
 - Command and Control relationships between Force Employers and Force Generators required further clarification. Elimination of Service specific applications and introduction of common datasets (Total Resource Visibility) are key enablers to addressing this challenge.

4.5 The Gaps

This prior research, definitional studies and exposure to Command Post Exercises provided the opportunity for the JCDS 21 team to familiarize themselves with existing Process, Organization and Technology and shortfalls. Significant findings were:

- Commanders must deal routinely with an increasing level of complexity – a broadening spectrum of interdependencies involving multiple stakeholders and disparate perspectives. An integrating framework and collaborative tools are missing and needed.
- Commanders rely on Subject Matter Experts and work by interdisciplinary teams. Staff will continue to play a critical role in decision support – mobilizing and collating knowledge, offering timely, coherent advice and coordinating and monitoring execution of activities. Consideration must be given to staff selection, training and organization, and the technology they use exploited wisely to support judgment.
- Information sharing is critical and information management (discovery, extraction, contextual setting, analysis and presentation) is currently problematic. Both fusion and assessment assistance is required.
- Efficiencies must be realized to satisfy the existing and accelerating pace of planning and tempo of operations. Today and tomorrow's battle rhythm requirements are/will assert claims.

5 Operational Requirements for Decision Support

5.1 Effects Based Planning (EBP)

The end of the Cold War has led to a period of resurgent nationalism and heightened extremism. Increased economic coupling has both expanded and obscured state interests and the proliferation of weapons and knowledge has empowered previously veiled non-state actors. Simultaneously, the rise of civil society and increased mobility have ‘shrunk’ the world accentuating increased interdependence, highlighting the significance of ‘values’, and blurring the traditional distinctions between war and peace, between strategic and tactical and between domestic and deployed. In short the current and projected security environment is notable for its volatility and complexity. Standing alliances have ceded primacy to selective engagement and *ad hoc* coalitions; sensitivity to collateral damage and casualties has underscored the importance of precision targeting, while pervasive media coverage and tacit recognition of opportunity costs of conflict has led to an increased focus on end-states and associated ways and means.

Effects Based Planning is a conceptual response to these factors. EBP is an attempt to address contemporary political challenges and attend to public expectations pertaining to the application of state power and military effectiveness. EBP can be viewed as both an extrapolation of the unity of effort principle and as an attempt to reverse engineer strategy; that is, to work back from a set of desired outcomes, or end-states. As such, it can be seen to epitomize Ralph Keeney’s value-focused thinking;²⁷ first agree upon end-state objectives, then determine the means to achieve it. Although not completely new to military strategy, it raises innovative departures from the “western way of warfare”. It encourages the ‘long view’ and attempts to foretell consequences and integrate a broader range of actions over time though acceptance of more probabilistic, less deterministic mental models. The concept also acknowledges the importance of the non-kinetic realm and argues for a more nuanced and agile approach to force employment to create outcomes which will contribute to achieving an overall goal.

5.2 Net Enabled Operations

Network Enabled Operations is a complementary concept and enabler to EBP. It leverages emergent business practices and exploits potential pervasive communications. Taking a holistic approach to security challenges involves coming to grips with multiple jurisdictions often with overlapping responsibilities. “Issue networks” coalesce around specific initiatives or functions. Some of these evolve into quasi-permanent standing networks while others develop and disband around a specific operation. It is this fluidity which poses both opportunity and challenge.

²⁷ Ralph L. Keeney, *Value-Focused Thinking: a Path to Creative Decisionmaking*, Harvard University Press, Cambridge, Massachusetts, 1992.

The military has long recognized the advantages of coordinating activities and therefore, developed staff models to support a Commander's ability to plan and direct large scale operations. Net Enabled Operations provides the conceptual basis for implementing "mission command" (centralized policy control and decentralized operational execution). The principles have been clearly articulated and are readily understandable, namely: a robustly "networked" force will improve information sharing between geographically dispersed units. This, in turn, will facilitate collaboration (vertical and horizontal) and generate shared situational awareness empowering self-synchronization and increased mission effectiveness. Net Enabled Operations envisages linking sensors, policy makers, actors/effectors and support personnel via a comprehensive information grid permitting full advantage to be taken of time and information superiority. In effect, it envisages Command and Control as a collective, devolved responsibility.

Point to point integration is increasingly problematic. Each interface requires tight coupling which restricts agility, and changes incur systems of systems engineering time and dollar costs. This is incompatible with the vision Net Enable Operations espouses of efficient and dynamic associations. System-of-systems testing and validation is likely to be distributed and will require consideration of boundaries, interfaces and behavioural performance.²⁸ This is likely to be unachievable in any single test event and will necessitate development of both a campaign plan and tools. This also speaks to the pressing requirement for addressing nomenclature, symbology, interaction protocols and human interactions to ensure usability (i.e., common vocabularies are needed).

Net Enabled Operations technology creates an environment which facilitates if not invites micromanagement. The ease of access provided through pervasive connectivity threatens to erode the traditional lines between the strategic, operational and tactical levels of war and permits interactive decision making. "To survive in the net-centric environment to come, a General must keep his strategic focus on decision-making ability, but with increased flexibility and the knowledge that he will inevitably answer to the bottom of the chain of command as well as to the top."²⁹ The creation of a social environment characterized by trust, self-restraint, and empowerment of subordinates is key.³⁰ Realization of Net Centric Operations are contingent on addressing organizational and technological issues, not least ensuring command intent is understood, control effectively exercised, and trust maintained.

5.3 Mission Command

The increasing complexity of operations poses substantive organizational challenges. Increasing staff specialization and rise of cross-functional decision and product teams have been introduced in response. Governance becomes a significant issue. Centralization offers the advantage of building organizational competence, strengthening policy control, pulling authority to the headquarters and bringing issues closer to the Commander. However it may

²⁸ US Department of Defense Systems of Systems, *Systems Engineering Guide Version 9*, December 2006; pg 13/14.

²⁹ Richfield, P. *Leadership Challenge* in C4ISR, 6(3), April 2007; pg 4.

³⁰ Korvettenkapitaen M.A. Altmeier. *The perils of Net Centric Warfare: Micromanagement, Moral and Combat Power in the Age of Information Technology*.

also limit exposure to expertise and innovation and constrain initiative and resolution of problems at lower levels. The objective in designing a Command and Control system is to balance these opposing forces and to exploit the merits each offers. Reducing uncertainty (insofar as possible) and timely access to information remains key to decision making irrespective of the model used. Similarly, an appreciation of “the bigger picture” is the key to encouraging agility and empowering coordination at lower levels. Thus establishing an effective Collaborative Information Environment is central to leveraging Effects Based Planning, Net Enabled Operations and Mission Command. The principles of visibility, accessibility and understandability underpin Net Enabled Operations and Mission Command concepts. The first suggests that unanticipated users may discover information; the second that they will pull the data if control policies permit and the third that they will be able to use the data.³¹

5.4 Collaborative Information Exchange

The Collaborative Information Environment must be capable of supporting simultaneous and multilevel planning, execution and sustainment/reconstitution activities. There are obvious links between the three; these can no longer be treated as sequential pursuits, and there is a requirement to track other ongoing and/or projected operations competing for Canadian Forces’ resources.

Focusing on outcomes, aligning tiered planning, and integrating activities are all inextricably linked to timely access to a pool of prior intelligence and expertise, and an accurate inventory of capability options. The latter will be critical in validating options (insofar as possible, a causal relationship) and identifying alternatives. Increasing interdependence dictates widening this virtual knowledge base and accepting outsourcing (i.e., drawing in specialists from Other Government Departments and from outside government). The key to success will lie in ensuring that the stored information and sources are identifiable, accessible, and explicable (i.e., readily understood). Not least, provision must be made for a common geospatial database. For the Canadian Forces, this will involve administering knowledge creation and transfer including socialization, externalization and internalization processes.³² Ontological engineering and metadata tagging will be needed in turn to support discovery and use applications. One of the immediate challenges is to move away from “templating” at the source necessitating integral mapping protocols towards more flexible knowledge storage. The key lies in separating data, services and applications.

Agility and self-synchronization in execution are linked to the accessibility of a common operating picture and shared understanding of intent and status. The intent of the staff should be to anticipate, to minimize constraints, and maximize subordinates’ freedom of action.³³ The CIE must be capable of supporting judicious dissemination.

³¹ US Department of Defense. (2006). *Systems of Systems Engineering Guide*: Version 9; pg 18.

³² Roy refers to Girard’s Knowledge Creation & Transfer cycle which depicts socialization as tacit to tacit, externalization (e.g. war stories) as tacit to explicit (e.g. lessons learned/ after action reporting) and internalization as explicit to tacit (e.g. training, simulation) transfer. He also identifies a 4th – combination (explicit to explicit) option (pgs. 54/55).

³³ Sparshatt, R. & Justice, N (Col), *Future Battle Command and Control System*, September 8 2002.

Resource utilization and time compression are as significant a factor as the “demise” of geography. Continuous integrated planning raises a requirement to consider sustainment and subsequent demands concurrent with the conduct and constant performance appraisal.

The notion of a comprehensive information grid/collaborative exchange environment is central to the operating concept being proposed. A “grid” offers image and significant advantages in terms of resiliency. Whereas it is easy to disrupt a node-to-node model, in a grid, the loss of a node can be readily compensated for and information flow redirected and dependencies reconstructed. The grid itself is dynamic; stations can detach and/or join. This speaks in part to several requirements, not least to maintain Command & Control (situational awareness and decision support) links with senior decision makers and to cater to emergent issue networks. Timely direction is needed to complement precise intelligence and accurate arsenals. Decision cycle times can be a factor. Senior leaders are often “on the road” and a portable link to the common operational picture and connection to superior, personal, and subordinate staffs is highly desirable.

Traditionally, information flows were coupled tightly to command relationships. Notwithstanding the addition of a deployable handheld decision support aid, Effects Based Planning, Net Enabled Operations, Mission Command, and Collaborative Information Environment concepts envisage a broader dissemination of information and a corresponding devolution of decision authority. Alberts and Hayes describe this as “Power to the Edge”.³⁴ The model poses three distinct challenges:

- Integrative: tools to facilitate access to and collation of information.
- Analytical: decision support assists to support diagnostic investigation, options development, and risk assessment; and
- Governance: a new behavioural rule set.

5.5 Complexity

Frequent reference has been made to the growing complexity and continuing uncertainty governing operations. Interdependence infers inclusion and the increasing number of factors and diversity of participants and perceptions to be considered renders the system complicated (i.e., characterized by having many moving parts).³⁵ Conversely complex endeavours involve non predictive behavioural changes: patterns may be discernable but small differences in initial conditions and/or minor perturbations may produce significant divergent outcomes. Future Command and Control systems must be designed to assist in directing complicated endeavours and in managing complex endeavours (raising alerts to conditional variations and catering for prompt adjustment).

The treatment of these security challenges as systems-of-systems is useful. An integrating architecture provides a means to structure information and depict relationships and attempt to accommodate multiple perspectives and to provide a departure point for contending with change. It is the operational and managerial independence of elements and emergent

³⁴ Alberts, D. & Hayes, R. Power to the Edge, Command and Control Research Program (CCRP).

³⁵ Alberts, D. & Hayes, R. Planning Complex Endeavours, CCRP; pg 6.

behaviour which preclude reliance on deterministic models. Put simply, at this point in time, it is impossible to foretell with precision the outcome of multiple cascading effects but, nonetheless, future Command and Control systems must provide for conveying situational awareness, supporting Command decisions and control in near real time.³⁶

5.6 Decision Rights

More than anything else, Command and Control is about the distribution of decision rights, whether between man and machine, between command levels, or between staff and line, or between individuals. To function successfully, competence, authority and responsibility must be aligned and the distribution of decision rights well understood. It, in turn, reflects organizational culture as much as embedded technology. A CONOPs is a collective, conceptual vision of system design and behaviour; it provides a target model.

Neither fully centralized nor fully decentralized, Command and Control systems are practical. As mentioned previously, the intent of EBP is to manage policy and the intent of Net Enabled Operations is to push down decisions. This reflects an agreed (theoretical) re-allocation of decision rights. The issue of residual decision rights is more problematic and requires more study.

5.7 Process Support Requirements

A process can be defined as an integrated set of sequenced activities that uses resources to transform inputs into outputs. Interconnectivity between activities is crucial (i.e., the output from one is the input to the next). Hence it is important to start from a holistic appreciation of Command and Control and understand relationships between activities and between critical business processes. In theory, Net Enable Operations are key to realizing Effects Based Planning. Decentralized execution is necessary to cope with system complexity and emergent behaviour. Mission Command and a Collaborative Information Exchange offer means to promote implementation coherence. Recently, Alberts (2007) has suggested that “Focus and Convergence” replace “Command and Control”.³⁷

This has significant implications for future C2 systems. Integration on a systems-of-systems level will require development of a robust communications “backbone” and agreement on standards and protocols. This must include effective and efficient JIMP interaction. Secondly, as noted earlier, Process, Organization and Technology co-evolve. Additionally there is a requirement to maintain operations while transforming. This underscores the need for modelling & simulation to ensure end-to-end functionality and reduce risk. Process Support Requirements include maintaining core service and competencies and system interoperability.

³⁶ There are several wonderfully illustrative representations of the challenge of managing “complexity” including the US historian Henry Adams description of some key historical turning points as a series of “accidents in corners” and, more recently, references such as “The Tipping Point”.

³⁷ Alberts, D. (2007). *Agility, Focus, and Convergence: The Future of Command and Control*, International C2 Journal, 1(1).

5.8 Situation Awareness Requirements

5.8.1 Monitoring Requirements

Timely collection and accurate depiction of information are fundamental prerequisites to “Focus and Convergence” related activities. Operational commanders, in this case CanadaCOM, will be asked to appraise situations and make decisions based on their appreciation of circumstances. In turn, they rely on collation processes, staff analysis and computer generated portrayals to provide a continuous representation of the area of interest. The requirement is to maintain an updated plot of what is known and what is unknown. The trend is for dedicated watch officers and staff to satisfy the monitoring function; they support both the Commander and the J1-9 staff who furnish detailed, specialist analysis and advice. Monitoring is a collective responsibility and appreciation of what is happening on the ground a culmination of Process, Organization and Technology.

5.8.2 Knowledge Management Requirements

Knowledge Management has become critical and will continue to increase in importance with emphasis on its effects. Tactical units rely on Intelligence and Information from superior headquarters. Increasingly, superior headquarters are becoming reliant on access to data from the field, which has two immediate implications: 1) information overload and the ability to collect information have outpaced the ability of many HQs to exploit it; and 2) proliferation of unit-unique databases renders collation and analysis problematic. Thus, a coherent strategy and effective Knowledge Management is needed.³⁸ Key enablers include the ability to categorize and access expertise.

5.8.3 I2 Analysis Requirements

Prior reference was made to the requirement to incorporate Intelligence and Information. The combination of deep analysis and current data underpins insight and enlightened decisions. There are Process, Organization and Technology impediments to achieving seamless integration of the two (i.e., different operating cycles, communities, cultures, databases and communications systems). The requirement is to integrate without compromising current strengths and valid security concerns and legislative mandates. It is noteworthy that J2 watch officers and Intelligence Liaison Officers are playing an increasingly important role as intermediaries.

5.9 Planning Requirements

5.9.1 Deliberative Planning

Deliberate Planning affords an opportunity for reflection and exploratory analysis. Hence it places a premium on digesting lessons learned and testing assumptions. Exercises such as ARDENT SENTRY have accentuated the value of contingency planning, in terms of

³⁸ C4ISR Commentary, C4ISR Journal, 6(4), May, 2007.

establishing process and personal relationships and in developing departure points for Reactive Planning. Tabletop exercises, modelling and simulation, and experiments are well suited to support Deliberate Planning. Prerequisites for success include access to innovative thinking, representative subject matter expertise, appropriate system imitation (process and technology), and supporting data collection, analysis and metrics. A scenario set provides for extrapolation, comparison, and validation of concepts and SOP/TTP refinements. There is an obvious need for periodic review and refreshment of contingency plans.

5.9.2 Reactive Planning

Conversely, Reactive Planning is invoked to a come-as-you-are crisis. Requirements are driven by an urgent need to understand current status and assess alternative Courses of Action. Training and education complement monitoring and contribute to Situation Awareness; Situation Awareness is necessary to ground option development. Connectivity to Peers, Partners and the Public is required to maintain a current appreciation. A key differentiator between Deliberate and Reactive Planning is time criticality. Given the increasing complexity of operations and cognitive limitations of humans, there is a requirement to exploit technology to assist in identifying factors/centre of gravity (COG) and deepening and accelerating collaborative Course of Action evaluation and Plan development. Unlike Deliberate Planning, provision must be made to accommodate emergent Issue Networks and provide for continuous review and adjustment. This identifies the need to be able to measure performance/track progress as part of the Monitoring process and to coordinate activities.

5.9.3 Sustainment

There are two dimensions to Sustainment stemming from the acknowledgement of the demands Continuous Planning imposes. Sustained Monitoring and Analysis “comes at a price” and more information tends to identify the requirement for more staff. ARDENT SENTRY detailed deficiencies in existing establishment levels. There will be continued pressure for the foreseeable future for Process, Organization and Technology efficiencies to restrain personnel growth. Distributed work sharing offers an attractive near term preference but is contingent on addressing governance issues and maturing links and tool suites. The second dimension relates to effective management of the pool of operational resources. The associated requirements include asset visibility including readiness levels and an ability to integrate across operations and project utilization to avoid violating rotational rules (personnel) and maintenance policies (equipment).

5.9.4 Personnel

Increased weapon portability and lethality underscores the requirement for effective Control and Communication. Concepts such as Network Centric Operations call for decentralized execution. Hence increased personnel recruitment, training and education will continue to be, if not more important, in the future. Selection processes may become more rigorous; some “futurists” envisage a requirement to monitor physical and mental well being. In addition to providing for customized presentation, there may also be a requirement to tailor processes and decision aids to the Commander and/or Command Style.

5.10 Command Requirements (Direct)

5.10.1 Support to the Commander

Process, Organization and Technology serve to support a Commander. Although doctrinally based, headquarters' daily reporting practices reflect the Commander's priorities. Increasingly, Commanders are more capable and comfortable with technology and appreciate and exploit desktop access to information. Nonetheless it is the staffs that provide substantive direct support; they serve as an extension of Command. Characterization might include three classes: 1) the Watch staff provides the Commander with a 24 hours/7 days a week monitoring capability serving as his/her eyes and ears. Typically a Commander will provide both Standing and Situation specific direction indicating when he/she is to be called or action initiated; 2) J1-9 staff are SMEs and provide specialist analysts and advisors. They provide input to established Communities of Interest; and 3) a Commander's personal staff attend to personal needs and facilitate administrative execution.

Although technology has empowered the Commander to extend horizons and enable personal intervention, information overload and complexity can have a paralytic influence. Operational tempo and accelerated decision cycles are having organizational impact. Reference has been made to the differentiation between Watch and J Staff s, Situational Awareness and Decision Support functions. Data fusion and presentation has become a distinct area of expertise in its own right with both dedicated staff and establishments (e.g., JIIFC). There has also been evolution within the J Staff; this remains a moving and appropriate area for study. J5 and J9 Sections are largely pre-occupied with Deliberate Planning. The J3 Ops Section has responsibility for both the oversight of immediate operations (up to 24 hours) and near term planning (24 – 48/72 hours) and staff are assigned accordingly. J1 Personnel, J4 Logistics and J8 Finance/Administration are expected to provide support across these temporal divisions. Perhaps most significantly the data management role of J6 C4 Systems has grown, and thought has been given to extricating process from infrastructure and establishing a knowledge management cell.

In summary, the requirement to support the Commander has and will likely continue to grow and organizational structure will continue to mutate in light of technological and associated procedural change.

5.10.2 Direction

No change is foreseen in the requirement for a Commander to provide unambiguous direction. Intent should be clearly articulated and readily recognized. Effects Based Planning, Network Enabled Operations, Mission Command and Distributed Operations all envisage decentralized interpretation and application of direction, underscoring the importance of leadership and tacit regulation. One challenge of modern operations is to reconcile diffusion with the traditional concepts, competence/authority, and responsibility. At the same time, it will continue to be impossible to supply prescriptive direction covering all possibilities and/or ensure comprehension and timely intervention from the Commander. Personnel selection and education play a large role. Additionally there is a need to establish consistency and familiarity with Process, Organization and Technology. Personnel stability and training can also contribute. However SOPs are also important. ARDENT SENTRY noted that direction

was provided by differing means making it difficult to anticipate when and how instructions would be passed.

It is often asserted that one can only manage what one can measure. Assessment is an essential component in any decision model. Ideally options and progress will be judged against computable/quantifiable performance indicators. The implementation challenges include translating higher level policy objectives into meaningful Measures of Effectiveness/Measures of Performance, integrating these into models to support comparative analysis of Courses of Action, and devising actionable collection plans to allow operational application to be monitored.

5.10.3 Risk Management

Decisions must be made in the face of uncertainty. Risk Management is an inherent part of Command. A Decision Support System must provide for articulating, evaluating, and mitigating risks. Risk Registers have been employed for a number of years. The extant challenge is to enhance objectivity in estimating risks and to address the demands an accelerated decision cycle impose. One way to address requirements may be to provide for models and catalogues based on previous, similar operations as a departure point.

5.10.4 Execution Monitoring Requirements

There are two key requirements relating to Execution Monitoring. The first requirement is to ensure that implementation is proceeding according to plan. As Moltke observed, plans do not survive contact with the enemy; hence there is a need to observe and intercede.³⁹ Increasingly plan adjustment and activity coordination must be completed on both operational and tactical levels in real time. This poses requirements for a current, common operating plot and robust communications.

The second requirement is to be able to confirm that these activities are contributing to the realization of strategic aims. Assessment of non-kinetic effects is particularly problematic; there is a need to develop appropriate, observable proxy indicators and to incorporate these into an overarching metrics framework relating higher level objectives to comparisons of COA to Battle Damage Assessment and theatre surveys.

³⁹ Wikipedia, http://en.wikipedia.org/wiki/Helmuth_von_Moltke_the_Elder, accessed September 27, 2007.

The observation actually originated with Helmuth von Moltke in the mid-nineteenth century. Von Moltke's version was not so felicitous, however: "No operation extends with any certainty beyond the first encounter with the main body of the enemy." In a process that's routine in the world of quotation, the Prussian field marshal's actual words were condensed into a pithier comment over time, then placed in more familiar mouths. Accessed at: <http://www.ralphkeyes.com/pages/books/quote/>, September 27, 2007.

5.11 Capability Based Planning (CBP)/Capability Management (CM)

With the fall of the Berlin Wall and demise of the Cold War, the DND/CF moved from a threat-based to a capability-based Force Development methodology. Capability Based Planning was envisaged as a response to increased uncertainty and volatility in the security environment and as a means to effect transformation. It was to be concept lead, to promote holistic (systems-of-systems) thinking and to challenge and replace an existing environmentally focused, platform-substitution culture. CBP came with its own set of challenges. The first challenge was to convert policy direction into actionable plans. It was anticipated that capability objectives could be derived through modeling; the decomposition of policy into missions and into tasks or activities followed by optimization across a spectrum of illustrative scenarios). Gaps in turn, could then be defined through comparison to existing Force Structure. Process, Organization and Technology solutions relating to a domain such as Command and Control would be integrated into a campaign plan and oversight provided by a Capability Manager.

Practical challenges included the fidelity of the scenario set, development of an appropriate decomposition schema, the one-to-many mapping of tasks to capabilities, and the difficulty assessing cross domain trade-offs absent of common metrics. A second series of challenges are related to capability integration. A number of elements combine to create a capability. In addition, relating Capability Based Planning to Capability Generation, to Business Planning, and to DND's organizational construct and devising a common Performance Management construct has proved difficult. Nonetheless the move to CBP/CM is significant for several reasons; not least, the C4ISR remains the poster child. Efforts will continue over the next year to consider C4ISR requirements, agree upon on a campaign plan/road map, and to develop processes and tools to support portfolio management.

5.12 Summary of Operational Requirements

A number of general deductions and a series of Operational Requirements can be extracted from this review of Command and Control and Decision Making models including:

General Deductions

- The future security environment will be characterized by greater ambiguity, continued uncertainty, and less predictability;
- Global interdependence will require international presence and continued CF deployments abroad;
- There will be increased emphasis and expectations placed with respect to CF support to domestic operations;
- Effects Based Planning will require a broader perspective (an expanded planning scope will become the norm);

- Decisions will cut across a wide range of societies, cultures, politics, and economics; and
- Increased complexity will result in increased reliance on decision support technology (e.g., modeling and simulation) and emphasis on implementation oversight and agility.

The Human & Organizational Perspective

- Increased operational and managerial interdependence will place a premium on collaboration;
- Organizations will be characterized by cross functional decisions and product teams;
- Multi-Agency and Coalition military operations will require leaders to consider different cultural values;
- Technological complexity, both structural and interactive, will characterize organizations (the J1-9 Continental Staff System may require review/alteration);
- Net Enabled Operations will require creation of a social environment characterized by trust, self restraint and empowerment (this may impact on leadership style); and
- Continuous learning is key to being kept informed as operations become more intricate.

Situational Awareness

- There will be an increased need to share and protect information;
- Knowledge Management is a key enabler but also an imposing challenge;
- Tools will be needed to:
 - Create a virtual knowledge base;
 - Support knowledge discovery and retrieval;
 - Ensure disseminate of accurate information to the right person at the right time in the right format (push); and
 - Allow for unanticipated exploitation (pull).
- Provision should be made for emergent Issue Networks;

- A Common Operating Picture will be needed to inform centralized policy formulation and optimize decentralized execution; and
- Information overload will be a concern (filtering and effective visualization will be required to convert presentation into understanding).

Planning & Decision Support

- Decisions will have to be made at a much higher rate and higher tempo;
- There will be closer scrutiny of decisions (e.g., public/media focus) and emphasis will continue to be placed on accountability;
- The stress level of the decision maker will increase;
- The “One solution fits all” approach will not be successful;
- Collaborative and Analytic tools will be required to support decision makers to facilitate:
 - Synchronous and asynchronous communications and document editing;
 - Time and space planning/synchronization;
 - COA Options Analysis and Risk Mitigation;
 - Logistics feasibility; and
 - Process (e.g., IPB, OPP, RFI) Management and Tracking.
- Effects based planning involves many staffs, and the product is so detailed that a shared database is a prerequisite.

Implementation Oversight

- In addition to monitoring execution, there will be an increased requirement to measure progress in relation to desired outcomes;
- Performance parameters established during the Planning process should provide advance warning of potential system failure; and
- Situational Awareness, Planning and Decision Making, and Implementation Oversight will become more tightly coupled as integral parts of a continuous process.

6 JCDS 21 CONOPs

A Concept of Operations evolves from a concept or suite of related concepts, reflects overarching principles and describes operations, i.e. how a set of capabilities may be employed to satisfy objectives and achieve a desired end state. Previous chapters provided the theoretical background and outlined operational requirements deriving from the Canadian Forces “vision”. This vision is emergent in iterations of a Strategic Operating Concept⁴⁰ and other documents. Environmental factors – continuing uncertainty and increasing interdependence – and the underlying concepts – Effects Based Planning, Net Enabled Operations and Mission Command – have been outlined in previous chapters. This JCDS 21 CONOPs focuses on realizing of Decision Superiority.

Decision Superiority: the ability of the commander, based upon information superiority and situational understanding, to make effective decisions more rapidly than the adversary, thereby allowing one to dramatically increase the pace, coherence, and effectiveness of operations.

U.S. Joint Forces Command Glossary
www.jfcom.mil/about/glossary.htm

The key to Decision Superiority lies in knowledge management and exploitation. Three overarching principles can be identified.

6.1 Overarching Principles

The first overarching principle relates to unity of effort. The CF has articulated the requirement for Decision Support to be “command centric”. A US study into lessons learned following Hurricane Katrina distinguished between Unity of Command and Unified Command.⁴¹ The former describes a hierarchical organization construct and well defined reporting lines. The latter an extension of the Incident Command System in which designated representatives work together to establish common objectives, agree a plan and coordinate actions. JCDS 21 is engaged with a number of stakeholders and involves cooperation across disciplines and partnership between labs. Cohesion and inclusion are important enablers and unified direction is a key to success. Command and Control is a very dynamic domain. JCDS 21 must continue to work with the broader community to appreciate emergent needs,

⁴⁰ Although a *Canadian Forces Strategic Operating Concept* has not yet been formally approved and published, the process has been useful in promoting a discussion and distillation of ideas. There has been both general acceptance and continuity through iterations of the concepts cited (e.g., April 2004, July 2005, and subsequent drafts).

⁴¹ Frances Fragos Townsend, *The Federal Response to Hurricane Katrina Lessons Learned*, Washington, D.C. February 2006.

determine opportunities and assess potential “solutions”. JCDS21 must maintain close liaison with key stakeholders (e.g., C4ISR Capability Manager, Headquarters Staffs Director Project Delivery Operational Information Systems [DPDOIS]) to ensure unity of effort. The JCDS 21 program must be inclusive and attempt to incorporate perspectives and focus efforts.

Cohesive Visioning

A Joint Command Decision Support should be developed around agreed concepts, a shared vision and ongoing unity of effort.

Collaboration is one piece of the puzzle; program integration another. As the decision-making includes four different domains (cognitive, knowledge, organizational & observable), a successful command decision support TDP must create an integrated view of the different dimensions influencing the Commander’s ability to make decisions. All three POT axes must be addressed. Human-Human, Human-Organization and Human-Technology thrusts should be integrated, and the integration based on fully net-enabled and connected forces with a command-centric philosophy.

Command and Control/Decision Support is a broad field, and the programme is categorized according to work breakdown elements. It will take continuous effort to ensure interoperability and optimization, to maintain vertical and horizontal cohesion within and between Work Breakdown Elements (WBEs) & along POT axes, and to keep pace and stay aligned with related initiatives. JCDS 21 lacks the luxury of fixing one thing at a time. It can be viewed and should itself be managed as a system-of-systems.⁴² WBEs will be loosely coupled and boundaries porous. Many, if not all of JCDS 21 initiatives have structure, information, function, operation, and/or generation dependencies. Key to success will be client oversight, periodic review and program adjustment.

Integration

A Joint Command Decision Support should be developed around a system-of-system vision integrating process, organization and technology enhancements and leveraging investments to achieve decision superiority.

JCDS 21 might equally be characterized as a complex adaptive system; provision must be provided for changes in the environment. Conventional systems engineering is requirements-driven. Complex adaptive systems design must cater for “rampant uncertainty, persistent

⁴² Distinguishing “system of systems” characteristics includes the degree of diversity, component autonomy and emergent behaviour.

surprise and disruptive innovation”.⁴³ Hence JCDS 21 achievement will also be linked to integration over time. Complex adaptive systems are, of necessity, built in increments. Given urgent requirements and the pace of innovation, the majority of the work programme will focus on incremental/evolutionary change, the immediate/next generation support to operators. Concurrently the TDP team will be asked to identify where revolutionary change may be warranted. New ideas must be incorporated on the fly. “Thinking about command and control must be conceptually based, rather than focused on technology and material”.⁴⁴ The JCDS 21 CONOPs provides for cyclical conceptualization, assessment, integration and capability.

Incremental Progress

A Joint Command Decision Support should be developed around continuous, successive enhancement and capability augmentation.

Although these latter imperatives will not be discussed further, they have been addressed. Beyond Project Management (SP1 - sub-project 1), System Integration & Interoperability (SP6) involves design and construction of a test bed to support integration, and to provide the means to carry out rapid prototyping and trial procedural, tool and system improvements.

6.2 Human and Organization Perspective

Understanding Human and Organizational Factors

Joint Command Decision Support should be conceived based on a sound appreciation of Human and Organizational sciences. Support cognitive capacity, shared situation awareness, common intent, trust in distributed teams and in automation, and communication and information strategies are key foundations joint decision effectiveness.

SP3 focuses on the human and organizational factors with a view to characterizing interactions between stakeholders, facilitating collaboration and improving decision performance in the complex and dispersed environment. SP3 will investigate the implications of theories such as net enabled operations on individual and team decision making (roles and rules). Underlying assumptions (e.g. more information is helpful, information polling will

⁴³ Boardman, J. and B. Sauser.. (Apr 24-26, 2006). “*System of Systems - the meaning of*”, IEEE International Conference on System of Systems, Los Angeles, CA. Paper accessed via web: http://personal.stevens.edu/~bsauser/index_files/pdf/Boardman%20IEEE%20SoS%20Conf.pdf (Accessed August 16, 2007).

⁴⁴ US DoD, Joint Vision 2020

lead to shared interpretation) need to be validated and issues (e.g. cognitive capacity and readiness, trust in distributed teams and in automation) explored to determine whether implementation will complicate command competency, authority and responsibility. Three WBEs have been identified:

- The objective of the first work package is to identify and characterize the interactions of the expanding stakeholder community. A broad range of interests are represented and organizations will be required to integrate disparate Command and Control systems, processes, and philosophies to ensure activities are coordinated and desired effects achieved. An understanding of information interoperability and the impediments to communications and trust will inform **Preparedness** and **Response** planning and performance.
- The aim of the second WBE is to propose a preliminary concept of operations and explore partnership (e.g., to identify requirements to enable collaborative work in a JIMP environment).
- Finally, WBE3 will examine decision effectiveness with a view to identifying factors and proposing performance measures. Sub thrusts include investigation into how information is integrated/advice exploited in making decisions and the importance of a Commander's decision making style. Earlier reference was made to the potential for micromanagement and the need to inculcate restraint and trust. The development of a decision style assessment tool will potentially provide objective evidence relating approach to context and serving as a training guide for styles to task matching.

Personnel stability and residual experience is a major DND/CF concern. As much as 25% of the CF's time is devoted to training, and approximately 1/3 of headquarters staffs at each level rotate (change appointments) each year. It is important to optimize training; which represents a significant resource commitment. Collaboration is fundamentally a human and social activity. Consequently such turnover poses challenges in maintaining a knowledge base and in sustaining trust. Identifying key decision making factors and developing Measures of Effectiveness will help to avoid subjectively driven agendas and to establish investment priorities and permit progress to be tracked.

6.3 Situation Awareness

Enabling Individual and Collective Situation Awareness

Joint Command Decision Support should enable seamless individual and collective situation awareness.

“During CMX 05 achieving Decision Superiority was found to be critically dependent on building a shared, common awareness of crisis situations”.⁴⁵ SP4 is focussed on the representation and management of information and knowledge with an initial focus on CanadaCOM. The preliminary Gap Analysis suggested that this is an area ripe for research and development (R&D). The requirement for integration and analytical tools to realize Effects Based Planning, enable Net Enabled Operations and to exploit a Collaborative Information Environment is obvious. Both the interviews and observations affirmed information discovery and retrieval and knowledge exploitation are problematic. The goal is “seamless situational awareness”. This will involve improved integration between systems, timely fusion and tailored depiction. WBEs include:

- Development of a search tool to address the difficulty identified in the Front End Analysis in terms of locating existing information. Such a tool is crucial to taking full advantage of a virtual knowledge base. **Knowledge Mapper** (KMapper) will display knowledge assets (e.g., individuals, documents, processes and concepts) and illustrate links. This is significant as knowledge needs to be both accessible and situated contextually; the gap analysis noted in particular the need for staffs to be able to readily evaluate the knowledge source. Although it will not address integrity issues directly, Knowledge Mapper will facilitate exploitation of existing databases and location and identification of assets.
- Addressing the requirement for an adaptive, user-centric **Portal** to facilitate efficient information manipulation and visualization was raised in an earlier discussion. Portals provide access to shared information and applications. Considerable effort has gone into developing *Command View*. JCDS 21 proposes to contribute to development of an advanced portal through progressive, incremental changes. Having a fielded system allows for continuous feedback. Moreover It is expected that *Command View* will become the primary source for DND/CF information and support decision making on all levels. The requirement to cater to multiple audiences creates challenges. An integrated system is required; a common data set is needed to foster a shared appreciation of the problem space. A common application suite will reduce training costs and contribute to staffing agility. Conversely, the requirement to support strategic, operational and tactical commanders and staffs requires *Views* (within *Command View*) be customized, particularly in time critical situations. This includes accommodating traditional geographic filters and providing for synthesis (production of a high level amalgam) and /or detailed analysis (drill down). Stakeholders may also require a functionally oriented *View* e.g. a Recognized Logistics Picture. The intent of this subproject is to incrementally enhance *Command View*.
- A “buy and try” deployable collaboration facility (**LiveSpaces**) has been procured from Australia. It will provide the means to assess the value of a deployable reconfigurable workspace to support team interaction. *LiveSpaces* is envisaged as an addendum to, and complements the ACCESS network. Sites are connected

⁴⁵ White, Orrick. (2006). *The State of the Art and State of the Practice: Achieving Decision Superiority at NATO Headquarters*, DRDC, Command and Control Research Program (CCRP) Submission #c-110. pg. 5.

using existing communications networks. Videoconferencing and a shared suite of web-based tools facilitate information sharing and enhance collaborative analysis and planning by distributed staffs.

6.4 Planning and Decision Support

Facilitating Joint Reactive and Deliberative Planning and Decision Analysis

Joint Command Decision Support should effectively support time-critical as well as deliberative collaborative joint planning, distributed team problem solving and options analysis.

“A decision without analysis is akin to a trip without roadmaps”.⁴⁶ The provision of situational awareness is the prelude to informed analysis, adaptive planning, and effectual management of operations. The sheer complexity of the operations in the 21st Century requires investigation, trial and adoption of more sophisticated decision support aids. Again, a number of separate Work Breakdown Elements have been identified:

- There is a pressing need to develop a coherent appreciation and an agreed **Integrated Decision Support Concept**. This will be realized through a literature search and engagement with the operational community via a workshop(s).
- There is a requirement for **Total Resource Visibility**. Logistics, Readiness and Sustainability are critical planning factors. A big part of the Command and Control challenge revolves around administering and managing resources in the face of uncertainty. The intent of Total Resource Visibility is, where possible, to eliminate unknowns relating to Own/Blue Forces. Current, reliable, synthesised resource-related information will highlight shortfalls early on, ensure impact analyses are accurate and support enlightened decisions. Importing and exporting information to and from Peers and Partners will be needed to provide a complete picture. Total Resource Visibility must support both incident planning and continuous planning. There is a requirement to present contingency operations as both a discrete event and part of a continuum. There are often several engagements running at one time and resources continue to be consumed and reconstituted between contingencies. With the current/projected operations tempo, staff focus will continue to transfer. Total Resource Visibility is needed to support arbitration, allocation, and adjustment of resources, and longer term feasibility planning. As highlighted in the JSTAFF Front End Analysis report (Greenley, Baker & Cochran, 2006), most issues the JSTAFF dealt with a required resolution/decision within a week, but had longer term implications. Total Resource Visibility should also provide for a “dashboard” highlighting asset status. Beyond visibility tools such as predictive modelling and concepts such as

⁴⁶ US Government, *Decision Processes*, Executive Summary, <http://www.usbr.gov/decision-process/analysis.htm>, as cited in: Disbrow, Lisa. (2002). *Decision Superiority: Transforming National Security Decision-Making*.

Sense & Respond Logistics need to be considered and advantage taken of emergent technology such expert/intelligent software agents.

- Information and Intelligence must be readily comprehensible and sources must be recognizable to a Commander and staff, since they are often working while tired, as well as under considerable time constraints. The JSTAFF Front End Analysis (Greenley, Baker & Cochran, 2006) emphasized the requirement for fusion and meaningful representation.⁴⁷ The concept of **Decision Boards** is to develop executive dashboards, a configurable/ reconfigurable display of information pieces the Commander deems critical including predetermined triggers.
- The requirement for improved **Risk Management** tools and processes appears self evident. Greater objectivity, better defined metrics, and a more traceable and responsive process for investigating mitigation strategies would enhance decision support.
- The case for a **Handheld Decision Support Tool** has been detailed previously. The intent of this work break down element is to refine user requirements.
- It is often difficult to assess options when faced with complexity (e.g., multiple stakeholders, diverse issues, and a dynamic situation). The intent of developing a **Management Tool** is to assist in framing the problem/identifying factors and supporting multi-criteria decision making.

Another very important requirement is to **Monitor Execution** and to provide clear, comprehensible feedback linked to the plan and allows progress to be tracked, and adjustments to be made in near if not real time. The performance parameters established during the planning phase that are linked to the desired effects should provide measurement standards and advance warning of failure.

Supporting Execution and Plan Management

Joint Command Decision Support should support execution oversight and facilitate plan repairs and timely corrective adjustments.

No plan survives contact with the enemy. Perhaps now more ever given the complexity and tempo of operations there is an imperative to monitor implementation and adjust plans accordingly. Although not the subject of a discrete WBE, this requirement is implicitly acknowledged in WBEs 3, 4 and 5. JCDS 21 must support systemic recognition when and where intervention is required and provide for timely analysis of corrective options. This will involve addressing human & organizational capacities, presentation of unfolding operations (e.g., timely alerts) and provision of time-sensitive decision support tools.

⁴⁷ Table 1: Gap Identification and Relationship to the JCDS21 Sub-Groupings; Section 4.2.

6.5 Summary

Each subproject and each of the Work Breakdown Elements has a part to play and offers a unique contribution to realization of the JCDS 21 vision of Decision Superiority. They might well be characterized as a set of stocks. It follows that a holistic appreciation, continuous monitoring of market and active oversight will be required to manage the JCDS 21 portfolio.

7 Illustration of JCDS 21 CONOPs: Application of the Planning/Operations/Response Model

7.1 Illustrative Vignette: Application to a Domestic Humanitarian Scenario

Scenarios have become an increasingly important enabling tool in Force Development. They provide the contextual setting and representative missions for Capability Based Planning, serving to assist in constraining abstraction and subsequently, as a test bed to evaluate options. DND/CF has recently revitalized their scenario set and begun to conduct analyses to establish capability goals and define capability requirements. Scenario 2 (described below) prescribes the requirement for the CF to provide Humanitarian Assistance to Provincial and Municipal Authorities following a natural disaster.

In the scenario, a massive earthquake, registering 8.5 on the Richter scale, has occurred 150 kilometres off the British Columbia/Washington coast. The earthquake, in turn, has generated a substantial tsunami, which due to its proximity to the coast, has struck without warning. The west coast of Vancouver Island and significant portions of the BC lower mainland, including the Greater Vancouver Regional District (GVRD), and the lower Fraser River valley have been overwhelmed. In the hours following the disaster, a provincial state of emergency was declared and a formal request for assistance was made to the federal government. The Prime Minister (PM) declared a national emergency, designating Public Safety and Emergency Preparedness Canada as the lead department/agency, responsible for co-ordinating the federal government's response. Subsequently PSEPC has requested DND/CF assistance.

It is envisaged that at the outset, the CF will be engaged in self-recovery, damage assessment, light urban Search and Rescue (SAR), First Aid, Medical and Casualty Evacuation (MEDEVAC and CASEVAC) and critical infrastructure repair. Priority is also likely to be assigned to re-establishing mobility including critical air and sea points of debarkation (APODs/SPODs). It is also probable, given the extent of the damage to the infrastructure and that many of the agencies involved lack an operational level C2 capability, that the unique, deployable Command, Control, Communications and Computers (C4) capabilities of the Canadian Forces will be called upon and used to augment and reconstitute the C2 structure and facilitate coordination in the affected theatre. Assistance to Law Enforcement Agencies (ALEA) may also be called upon.⁴⁸

The following illustrative vignette presents the authors' view of how JCDS 21 enabled C2 enhancements might serve CanadaCOM in the event of a future domestic humanitarian crisis.

⁴⁸ In some of the literature a useful distinction is made between a "disaster" and a "catastrophe" (i.e., this scenario depicts a catastrophe as the facilities and operational bases of almost all local emergency operations are out of commission). This has Force Employment implications as the CF may be asked to help backfill.

7.2 Preparedness (Deliberate Planning)

Response to the humanitarian crisis will be conditioned by **Preparedness** measures taken before the earthquake struck. In particular, under the auspices of PSEPC, a series of workshops and Command Post Exercises were held providing an opportunity to contrast and align doctrine, to identify interoperability challenges and develop mitigation strategies, and to establish Standard Operating Procedures. The series of exercises and experiments, many using the JCDS 21 Test Bed, provided an opportunity to evaluate concepts, and also to develop an inventory of resources and to establish personal relationships. This provided an opportunity for furthering research, including: 1) characterizing JIMP interactions; 2) for testing decision effectiveness performance measures and for 3) shaping process, organization and technology investment. The resultant conclusions and documentation supported expansion of an inter-department exchange program and informed professional development and training programs reflecting decision style-to-task findings.⁴⁹ These workshops and CPXs have provided the base for development of deliberate plans, now captured in digital models complementing paper plans. That said, “the production of a document or a written plan, while sometimes legally necessary, is never as important as the planning process”.⁵⁰

Architectures provided a means to articulate concepts, document dependencies and develop models. The subsequent move to Executable Architectures permitted examination of systems behaviour under dynamic conditions and progression to more sophisticated constructive simulation. The traditional table-top, paper based CPXs have been largely replaced by virtual and constructive simulations providing the means to also stimulate refinement of *Command View*, transition towards a full fledged CIE, and development of visualization and analysis techniques.⁵¹ The development of a simulation capability able to support dispersion, pandemic, behaviour and adaptive risk modeling⁵² proved a seminal investment. Simulation has been used to buttress C2 training and support mission rehearsal, to trial enhancements to a C2 portal and study decision making and to support operational planning.

⁴⁹ “While commanders in the midst of battle will and should depend heavily upon intuition, their intuition can be much improved by peacetime education and training that has been structured to teach the right lessons, build the right pattern-matching skills, and *debias* the decisionmaking judgement.” Paul Davis, pg. xiv.

⁵⁰ “There tends to be a focus on written disaster plans. But good planning instead focuses on such processes as: undertaking public education activities; establishing informal links between key groups; assessing, monitoring and communicating information about local risks; holding disaster drills, rehearsal and simulations; developing techniques for training; knowledge transfer and assessments; convening meetings to share information; obtaining the involvement of citizens, businesses, and non-emergency public agencies and relevant non-local groups in the planning process; and updating strategies, resources and laws as necessary” (Quarantelli, E.L. *Disaster Related Social Behaviour: Summary of 50 Years of Research Findings*, Disaster Research Centre University of Delaware.

The planning process forces people “to think, to collaborate and determine who is doing what, who has authority and responsibilities”. It also helps determine capabilities and define requirements (Findley, E (LGen). (2006). *Transforming NORAD*, Vanguard.

⁵¹ PS is considering creating a National Visualization & Analysis Centre (NAC)

⁵² For example, risk outlook.

7.3 Continuous Planning and Routine Operations

Activities such as Maintain Situation Awareness and Monitor Routine Operations are continuous activities and the battle rhythm is determined by a routine, and highlighted by an established meeting schedule. A notable shift in recent years has been the shift from prepared briefings towards focused discussion. Command View provides an accurate, accessible presentation of ongoing activities allowing Commanders and Staffs at all levels to familiarize themselves with the “state of the union” at their convenience prior to the daily Staff meeting. The daily meetings allow for information exchange and an opportunity to consolidate shared Situational Awareness. They provide an opportunity for:

1. Staff officers to draw a Commander’s attention to issues and to solicit direction;
2. The Chief of Staff to coordinate staff efforts/direct the headquarters’ work program; and
3. A Commander to exercise leadership and establish personal bond with his/her supporting cast.

Reference to supporting data is available through the portal and Decision Boards.

In this case Command View notes mounting geological disturbances on the West Coast but such activity has recurred periodically. However, while there is no substantive indicator suggesting that a massive earthquake is looming, the alert captures Commander CanadaCOM’s attention; the Commander suggests J3 review the existing contingency plan and directs the COS/J2 to initiate a formal Request for Information so that in the future it is known how much weight should be placed on such reports.

7.4 Response (Contingency Planning/Operation)

Within moments of the earthquake/tsunami (reported simultaneously by government and media sources) the Watch Staff initiate a recall and establish contact with their SJS and Joint Task Force Pacific (JTFP) counterparts. Horizontal liaison and integrated response planning begins immediately, facilitated by CIE-enabled tailored views and collaboration tools. In anticipation of forthcoming orders CanadaCOM COS convenes a Battle Staff Meeting to consolidate advice and coordinate staff activities. The staff’s immediate priority is to collate information, impose coherence and present a comprehensible picture, in order to establish situational awareness.

Investment in Core Services and a CIE pays dividends. Staff officers have a single multipurpose computer on their desks which allows access to the DND/CF network, a common application suite, and links to external partners once personal identification is validated. Equally important, the advantages of progress made in developing a functional capability to exchange information have reduced prior “air gaps” and allow staffs to spend more of their time analyzing data rather than accessing it. A great deal of information is accessible through the virtual knowledge base. In other cases, deficiencies are noted and staff officers are assigned responsibility to fill in the gaps insofar as possible. Where necessary, the requirement is J2 related, the formal Request for Information process is invoked.

In **Response** to the Request for Assistance channelled through PS, the SJS meet and prepare a Strategic Initiating Directive for the CDS’ approval. Their appreciation of circumstances and situational analysis was informed by input from peers, partners and subordinates and depicted by Command View. Command View provides for population of the same display by dispersed

stakeholders and presents the culmination of collaborative collection and analysis. The contributing information channels include open source material and reflect standing and emergent Issues Networks. The recognized common operating picture Command View presents is a comprehensible, scalable and tailorable, portrayal of the disaster and assists the SJS in preparing the ground for decisions on strategic commitments. It provides a dynamic depiction of ongoing tactical operations including an ability to drill down to the level of detail required. The representation is refreshed continuously by information from the GOC, JTFP, and other sources, which are posted immediately, scrutinized by the Watch Staffs and collated by JIIFC. Correlating and characterizing the data to facilitate comprehension of the extent of the crisis is important and JIIFC staffs rely heavily on technological assistance. Presentational protocols represent prior investment in visualization research and development and provide for attention to be drawn to conditional changes. As the extent of the calamity emerges Command View provides an acknowledged “ultimate authority”. Equally importantly is the prior attention paid to making Command View “user friendly”. Senior officers have limited time for training, and limited patience, given the demands that ambitious schedules and compressed decision cycles impose. Staff officers are routinely reappointed and considerable effort has been made to accommodate intuition and reduce keystrokes.

External inputs are incorporated to provide a comprehensive appreciation. Prior provisional arrangements for streaming commercial satellite photography have been activated; these will be used to supplement 2-dimensional (2D) and 3-dimensional (3D) area models maintained in imagery library. Information in regards to damage to the regional infrastructure is being fed into the system by Industry Canada. The information received through the Emergency Telecommunications Operating Centre/GOC/NDCC, District Emergency Telecommunications Officer/Provincial Emergency Coordination Centre(PECC)/JTFP Headquarters and the media needs to be vetted, and insofar as possible, verified to gauge/assure integrity. There are inherent dangers in a “post then process” philosophy. Governance and effective management are key. Fortunately, an accountability framework has been agreed previously and roles and responsibilities are understood. The principle guiding collection is that the data/information should be collected and entered once by the closest/best placed source. Each COP contributor is accountable for the content they supply. An electronic log (time-stamped and geo-referenced) of all inputs and interventions is maintained for post mortems analysis.

Initiation, Mission Analysis, COA Development and Plan Development are components of a continuous integrated process. Success is contingent on collaboration between J2 (Intelligence), J3 (Operations) and J4 (Logistics) staffs, and in particular liaison is required between SJS, CanadaCOM, CANOSCOM and JTFP Headquarters. Consequence management also requires coordination with OGDs, Non Government Organizations (NGOs) and Industry. Surge capacity has breadth and depth facets. Typically with humanitarian relief scenarios, DND is faced with the challenge of “lateralizing”, connecting to multiple players and participating in virtual organization structures facilitating but not controlling interdependent coordination.⁵³

Within DND the Initiating Directive legitimizes the CF operation, nominates CanadaCOM to lead, and triggers CF mobilization and detailed employment planning. The Commander at

⁵³ Burkle, F.M. Jr. & Hayden, R. (2001). *The Concept of Assisted Management of Large Scale Disaster by Horizontal Organizations*, Prehospital and Disaster Medicine.

CanadaCOM was in the Atlantic Region visiting Canadian Forces Base (CFB) Gagetown. As he returns to Ottawa, he maintains contact with peers, partners, and subordinates through a deployable portal affording him access to Command View and communication with staff and liaison officers. Meanwhile the Rescue Coordination Centre collocated in Victoria with JTFP Headquarters is doing its best to direct SAR efforts on the West Coast of Vancouver Island. The Ready Duty Ship and Coast Guard units are diverted and directed to support SAR operations. Immediate Response Units prepare to deploy and Reserve Units in the Pacific Region are assembling. Exploiting the maritime domain awareness, the Esquimalt-based Maritime Security Operations Centre produces diversion plans. Shared knowledge and pooled CF, RCMP, Canadian Border Service Agency (CBSA), Transport Canada and the Coast Guard experience allow for informed decisions to be made. Some ships are rerouted to ports in the United States, and others to Prince Rupert. This is a prominent example of “actionable intelligence”.

The main focus of “now designated OPERATION ANGEL” will be urban centres; in particular, the Vancouver downtown/Richmond/Delta/Port Coquitlam core, the remainder of GVRD and Victoria. Media interest is insistent and important; the media have a dual role: 1) to report; and 2) to warn. The media are external observers and an integral part of a public emergency broadcast system. The requirement to coordinate timely preparation, approval and distribution of media lines generates unique process, organization and technology demands. The effort is directed by Private Council Officer (PCO) and PS and extensive use made of the existing GOC Public Affairs protocols and the CIE (e.g. video links, distributed document editing etc.). It is imperative for the CanadaCOM Public Affairs Officer (PAO) to maintain links through the PAO network and with the J3 staff and COS to ensure information contributions are accurate and Command approved, and that the Commander of CanadaCOM is aware of agreed media lines and planned releases.

Contingency planning progresses in parallel on several levels and full use is made of Chat, Email, secure VTC facilities; federated/contextual search engines, a document retrieval system, white boarding and distributed editing capabilities. The SJS are in contact with the GOC and other departmental emergency operations/coordination centres. Shared Situational Awareness has informed perception, understanding and projection. Following receipt of the Initiating Directive, CanadaCOM staff conduct their own (Operational Level) Mission Analysis, drawing on the Criteria Matrix which encapsulates prior knowledge (and lessons learned) relating to environmental disasters/humanitarian crises. As staffing progresses, a number of information deficiencies are identified and the virtual knowledge base is queried or RFIs are raised. Frequent use is made of human and technical connectivity and planning tools in collaboratively developing and comparing possible COAs. Corporate social networks provide access to external expertise.⁵⁴ Time is at a premium, and the COA evaluation module and simulation embedded in the latest release of the Collaborative Operations Planning System (COPlanS) proves useful in developing and representing options, highlighting potential execution challenges and assisting the staff in making recommendations. Several scenarios are enacted in accelerated time exploiting the simulation environment to assist CanadaCOM in negotiating appropriate Rules of Engagement. Full use is also made of complementary tools to focus the Commander’s attention on Risk Management. The automated register ensures a comprehensive staff check is undertaken and catalogues dangers,

⁵⁴ Gen y wired for Business, The Ottawa Citizen, 14 April 2007; pg. D12.

mitigation strategies, and residual risk facilitating CanadaCOM's decisions. Equally important is the linkage to execution monitoring permitting continuous near real time appreciation of risks and performance versus objectives. Both tools are used in preparing and presenting the Decision Brief.

DND/CF has a supporting role and derives its mandate from several different sources. The Government of Canada's (GoC) role and responsibilities in response to domestic crises are laid out in the Emergency Preparedness Act. Other legal instruments and memoranda provide for Assistance to Law Enforcement Agencies. Finally the National Defence Act provides for a process provinces to requisition CF support to prevent and/or suppress rioting and disturbances: Aid to the Civil Power (ACP). As CanadaCOM staff refines options, full use is made of Knowledge Mapper to ensure legal implications are fully understood. Kmapper provides a convenient tool to access base doctrinal sources and identify jurisdictional subject matter experts.

In accordance with the Federal Emergency Response and National Support Plans, DND has assumed responsibility for Movements Coordination (i.e., organizing the transport of relief supplies and personnel into the lower mainland). This is a major undertaking given the extent of damage and number of NGOs offering assistance, and this necessitates continuous liaison with PS planners. The National Defence Movements Co-ordination Centre (NDMCC) must determine the status of APODs sans SPODs, direct preparation of Advanced Holding Zones and Staging Areas, maintain an inventory of transport assets, and administer tracking of requests and material/personnel requiring transport. Computer aided scheduling models prove a boon. Command View, a shared knowledge base and collaborative planning tools provide SJS and CanadaCOM insight into CANOSCOM plans and facilitate integration of CF and pan-Canadian movement planning.

Considerable co-ordination is required. Multiple points of entry into the Joint Operating Area (JOA) are required to support the relief effort. The initial CF response (within 24 hours of the event) consists of the delivery of personnel and light equipment by air. From Day 3 onwards, heavy equipment and resources is delivered by road and/or rail through Prince Rupert, then via sea to Victoria and the GVRD. Finally, after approximately Day 7 (once ground based lines of communication have been re-established), follow-on forces and equipment is delivered by road and/or rail through the Fraser Valley.

Concurrently JTFP staff are aligning their plans so that execution can proceed without delay. *Canada Command Direction for Domestic Operations* authorizes local commanders to respond promptly to requests for assistance to save lives, prevent suffering, and mitigate property damage, and Commander JTFP has recalled regular force headquarters staffs, ship companies, and aircrew and called out local militia units. Although there is considerable confusion in the wake of the earthquake/tsunami, information is gathered, clarifying the situation. JTFP directs immediate deployments using Command View to ensure that CanadaCOM are kept aware of these initial response efforts. The Commander JTFP has only recently taken post and is not intimately familiar with his counterparts. "Hockey cards" providing a visual introduction, organizational profile and personal details of participants are extracted from the CIE in preparation for his attendance at a regional coordination meeting convened on short notice by the provincial PS office to be held at the Provincial Emergency Coordination Centre in Victoria.

Total Resource Visibility is proving a godsend. It has provided a key common departure point. It has provided CanadaCOM, CANOSCOM and JTFP with a current, shared

appreciation of unit readiness and Departmental stock holdings. It has also afforded CanadaCOM “reach back” and highlighted where Force Generation might be accelerated in response to the earthquake/tsunami and facilitating dialogue with Environmental Chief of Staff (ECS) and CANOSCOM. Recently installed Radio Frequency Indicators permit minute-to-minute tracking of stocks. Although not an immediate concern, provision has been made by J8 staff to attribute and track costs.

Execution Management is as much a collaborative venture as contingency planning. Extensive use is made of shared information; the common operating picture reflects input from all stakeholders. Much of this data, particularly within DND/CF and between federated emergency response partners, where a robust CIE has been put into place, need only be entered once and, often/where possible entry does not require human intervention (e.g., information streaming from satellites). However, not surprisingly, given the number and diversity of stakeholders, in some cases manual importation and exportation protocols have to be established. SJS, CanadaCOM and NDMCC are relying on trend recognition and Decision Boards to assist in monitoring operations. Customized dashboards provide decision makers with the ability to aggregate information, track progress, and to insert triggers alerting Commanders when desired outcomes are in jeopardy and adjustments to extant plans required. In many cases these are linked to Commander Critical Information Requirements, standing direction prescribing collection and analysis priorities.

8 Summary

JCDS 21 has a mandate to support evolution of DND / CF Command and Control, to evaluate concepts, demonstrate technologies and propose strategies to realize decision superiority. Process, organization and technology all contribute to knowledge management, collaborative analysis, visualization, decision support and execution management. Considerable prior effort has focused on developing a unified model, conducting an initial gap assessment, and formulating a work plan. This Concept of Operations has been prepared to articulate JCDS 21's strategic vision and to provide a high level/overarching framework to situate the program for team members and sponsors. In addition it will be used to support development of a Functional Architecture. Key concepts such as Effects Based Planning, Net Enabled Operations, Mission Command, Collaborative Information Environment and Decision Rights have been summarized and linked to establish the conceptual base and relate key operational requirements to the Front End Analysis. A brief description of SP3, SP4 and SP5 has been included and a concerted effort has been made to use an illustrative vignette to demonstrate how these piece together, and may be exploited to support the Commander CanadaCOM.

CanadaCOM has unique responsibilities which include support to national civil authorities. The CF Vancouver scenario is particularly useful since it incorporates critical JIMP management challenges (information flow within and between organizations, distribution of decision rights and coordination of inter-organization activities). The vignette is illustrative, and it serves to highlight the importance of the crucial role of Command and Control, and the complexity of the JIMP challenge.

A systematic investigation of Human and Organizational Factors, Situational Awareness and Planning and Decision Support is required to provide a full understanding and to support DND/CF Transformation. The JCDS 21 WBE reflects these three axes but also recognizes that each has process, organizational and technology dimensions. This will pose both research and development and management challenges. Ongoing operations and exercises will continue to drive priorities and contribute lessons learned. This CONOPs proposes three overarching, interrelated principles and suggests JCDS 21 consider an conceptualization-assessment-integration- model-experiment-refine-capability approach. Vision cohesion, program integration, periodic adjustment and incremental enhancement are seen as the key to successful co-evolution, systemic coherence and realization of Decision Superiority.

9 Acronyms

2D	Two Dimensional
3D	Three Dimensional
ACP	Aid to the Civil Power
ALEA	Assistance to Law Enforcement Agencies
APOD	Air Point of Debarkation
BPM	Business Process Modelling
C2	Command and Control
C2IS	Command and Control Information System
C4	Command, Control, Communication, and Computers
C4ISR	Command, Control, Communications, Computers, Intelligence, Surveillance and Reconnaissance
C4+I	Command, Control, Communications, Computers and Intelligence
CAE PS	CAE Professional Services
CanadaCOM	Canada Command
CANOSCOM	Canadian Operational Support Command
CANSOFCOM	Canadian Special Operations Forces Command
CASEVAC	Casualty Evacuation
CBP	Capability Based Planning
CBRN	Chemical, Biological, Radiological, and Nuclear
CBSA	Canadian Border Service Agency
CCDO	Canada Command Direction for Operations
CCIRM	Commanders Critical Information Requirements Management
CCRP	Command and Control Research Programs
CDS	Chief of Defence Staff
CEFCOM	Canadian Expeditionary Forces Command
CET	Capability Engineering Team
CF	Canadian Forces
CFACC	Combined Forces Air Component Command
CFB	Canadian Forces Base

CIE	Collaborative Information Environment
CM	Capability Management
COA	Courses of Action
CONOPs	Concept of Operations
COP	Common Operating Picture
COPlanS	Collaborative Operations Planning System
COS	Chief of Staff
CPX	Command Post Exercises
CV	Command View
DCDS	Deputy Chief of Defence Staff
DND	Department of National Defence
DoD	Department of Defense
DoDAF	Department of Defense Architecture Framework
DPDOIS	Director Project Delivery Operational Information Systems
EBP	Effects Based Planning
ECS	Environmental Chiefs of Staff
ERP	Emergency Response Planning
ERMP	Emergency Response Management Plans
FAA	Functional Area Analysis
FNA	Functional Needs Analysis
FSA	Functional Solutions Analysis
GoC	Government of Canada
GOC	Government of Canada Operations Centre
GVRD	Greater Vancouver Regional District
HQ	Headquarters
I2	Information and Intelligence
IC	Industry Canada
ICS	Incident Command System
Integrated C2	Integrated Command and Control
IPB	Intelligence Preparation of the Battlefield
JCC	Joint Command Centre

JCDS	Joint Command Decision Support
JCDS 21	Joint Command Decision Support for the 21 st Century
JCIDS	Joint Capabilities Integration and Development System
JIFC	Joint Information and Intelligence Fusion Capability
JIMP	Joint, Interagency, Multinational, and Public
JOA	Joint Operating Area
JTFA	Joint Task Force Atlantic
JTFP	Joint Task Force Pacific
Km	Kilometre
KM	Knowledge Management
KMapper	Knowledge Mapper
LISI	Levels of Information Systems Interoperability
MEDEVAC	Medical Evacuation
MOE	Measure of Effectiveness
MOP	Measure of Performance
MORS	Military Operational Research Society
M&S	Modelling and Simulation
NAC	National Visualization and Analysis Centre
NDCC	National Defence Command Centre
NDHQ	National Defence Headquarters
NDMCC	National Defence Movements Co-ordination Centre
NGO	Non-Government Organizations
OGD	Other Government Departments
OODA	Observe, Orient, Decide and Act
OPP	Operations Planning Process
OV	Operational View
PAO	Public Affairs Officer
PCO	Private Council Office
PECC	Provincial Emergency Coordination Centre
PM	Prime Minister
POT	Process, Organization, and Technology

PS	Public Safety
PSEPC	Public Safety and Emergency Preparedness Canada
PSTP	Public Security Technology Programme
R&D	Research and Development
RCMP	Royal Canadian Mounted Police
RFI	Request for Information
RJTF	Regional Joint Task Force
ROE	Rules of Engagement
SA	Situation Awareness
SAR	Search and Rescue
SIT REP	Situation Report
SJS	Strategic Joint Staff
SME	Subject Matter Expert
SOC	Strategic Operating Concept
SOP	Standard Operating Procedure
SP	Sub-Project
SPOD	Sea Point of Debarkation
TD	Technology Demonstration
TIM	Target Implementation Model
TTP	Tactics, Techniques, and Procedures
WBE	Work Breakdown Element
WBS	Work Breakdown Structure

10 Glossary

Commanders Critical Information Requirements Management (CCIRM)

As part of operations planning the commander is required to identify the types of information that may be needed to support the operation.

Command & Control

C2 is “the exercise of authority and direction by a designated commander over assigned forces in the accomplishment of the force’s mission. The functions of command and control are performed through an arrangement of personnel, equipment, communications, facilities and procedures that are employed by a commander in planning, directing, coordinating and controlling forces in the accomplishment of the mission.”⁵⁵

Commander’s Intent

A concise expression of the purpose of the operation and the desired end state that serves as the initial impetus for the planning process. It may also include the commander’s assessment of the adversary commander’s intent and an assessment of where and how much risk is acceptable during the operation.⁵⁶

Effects Based Operations

The Canadian Forces Experimentation Center has retained the following working definition of EBO: “Operations designed to influence the long- or short-term *state of a system* through the achievement of desired physical or psychological effects. Operational objectives are sought to achieve directed policy aims using the integrated application of *all applicable* instruments of *hard/soft power*. Desired effects, and the actions required to achieve them, are *concurrently and adaptively planned, executed, assessed* (and potentially altered) within a *complex and adaptive system*”. According to the United States Joint Forces Command (USJFCOM), Effects Based Operations are the application of military and non-military capabilities to realise specific and desired strategic and operational outcomes in peace, tension, conflict and post-conflict situations. USJFCOM’s J9, Joint Experimentation Directorate, defines EBO as “a process for obtaining a desired strategic outcome or effect on the enemy through the synergistic and cumulative application of the full range of military and non-military capabilities at all levels of conflict.” The intent of the Effects Based Operations concept is to produce inter-dependent effects and not just to conduct actions in isolation. The planning, conduct and assessment of operations must reflect on one hand dependencies between national power entities, and the other hand the dynamic nature of the situation.

Net Centric Warfare

“Net Centric Warfare is an information superiority-enabled concept of operations that generates increased combat power by networking sensors, decision-makers, and shooters to

⁵⁵ Command Decision Support Capability (CoDSC) Principles & Goals (2003-09-03), Annex B.

⁵⁶ US Defence Technical Information Centre, DOD Dictionary of Military and Associated Terms, Joint Publication 1-02.Efewnce

achieve shared awareness, increased speed of command, higher tempo of operations, greater lethality, increased survivability, and a degree of self-synchronization. In essence, Net Centric Warfare translates information superiority into combat power by effectively linking knowledgeable entities in the battlespace”.⁵⁷

Request for Information

Request for Information are specific information requests to support operations, which are passed to authorities at higher, lower or adjacent levels.

⁵⁷ Alberts, D.S., Garstka, J.J. & Stein, F. P. (1999). *Net Centric Warfare: Developing and Leveraging Information Superiority*. Command and Control Research Program.

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14. ABSTRACT

This document proposes a Concept of Operations for the Joint Command Decision Support for the 21st Century Technology Demonstration Project. It summarizes key underlying concepts, describes the DND/CF Command & Control model and outlines emergent Situational Awareness & Decision Support requirements. A set of principles derive from this initial analysis and a domestic humanitarian scenario is used as an illustrative vignette depicting application. This CONOPs is intended both to situate the JCDS 21 work program and to stimulate dialogue.

Le présent document propose un concept d'opération pour le Système d'aide à la décision des commandements interarmées pour le XXI^e siècle relatif au Projet de démonstration de technologies. Il résume les concepts sous-jacents clés et décrit le modèle de commandement et de contrôle du MDN et des FC ainsi que les nouveaux besoins en matière d'aide à la décision et de connaissance de la situation. Cette analyse initiale a permis d'établir un ensemble de principes, et nous avons utilisé le scénario d'une opération nationale d'assistance humanitaire pour en illustrer l'application. Le concept d'opération vise à situer le programme de travail relatif au PDT ADCI 21 et à favoriser le dialogue.

15. KEYWORDS, DESCRIPTORS or IDENTIFIERS

JCDS, CONOPS, Command, Decision support, Decision making, Effects Based Planning, Net Enabled Operations, Collaborative information exchange